LOKEE TESTING Laboratory

United States
Environmental Protection Agency
Wood Heater Certification Test Report

Jotul North America

F370

Volume 1 of 1

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

United States
Environmental Protection Agency
Wood Heater Certification Test Report

Jotul North America
55 Hutcherson Drive
Gorham, ME 04038
F370

Volume 1 of 1

Report By:

Chip Wadington

CONFIDENTIAL

RELEASED ONLY BY
AUTHORIZED PERSONNEL

12/22/2008

TABLE OF CONTENTS

Page(s)		Section(s)
Introduction		
Title Page		i
Table of Contents		ii
Test Report (Data) Page Number Index		iii-v
Individual Test Run Page Number Index		vi
Test Series Information and Discussion		vii
Stove Storage Information		viii
Stack Measurements and Sampling Port Locations		ix
Stove / Catalysts Aging Data		x
Scheduling Information		varies
Summary and Discussion of Results		
Emission Test Summary	Data Summary	1
Emission Graph		1
Data Summary		2, 3
Individual Test Runs (Raw Data)		
See Introduction, Individual Test	<0.80 kg/hr	varies
Run Page Index for a complete,	0.8 - 1.25 kg/hr	varies
sequential list of data and data	1.25 - 1.90 kg/hr	varies
sequence in the individual test runs	>1.90 kg/hr	varies
	Fan Confirmation (if necessary)	varies
	Insert Confirmation (if necessary)	varies
Calibration Data	Cal Data	varies
See Test Report (data) Page Number Index, Item 14, for a complete, sequential listing of the data in this section.		
Stove Q C		
Stove Q C	Stove Q C	varies
Firebox Volume Dimensions		
Manufacturer's Drawings		
Manual Manual		
Manufacturer's Written Test		varies
Instructions (if provided)		
Manufacturer's Operation Manual		
Appendices:		
A: - Example Calculations		
B: - Installation Description and Operating Instructions		
Efficiencies		varies
A. Data Summary		
B. Individual Run Data		
Photos		
Photos of wood loads in and out of the test unit.	Photos	varies

PAGE NUMBER INDEX

	SECTION	LOCATION
1. Summary of Burn Rate and Emission Rate Results	Data Summary	Page 1
2. Summary Table of Other Data	Data Summary	Pages 2 & 3
3. Wood Heater Description	Stove QC	Page 1
4. Manufacturer's Testing Wood Heater Instructions	Operators Manual	Page 1
5. Test Chamber Installation Description	Introduction	Page 9
6. Wood Heater/Catalyst Aging Documentation	Introduction	Page 10
7. Wood Heater Dimensions and Usable Firebox Volume	Stove QC	
8. Pretest Burn Procedures	Individual Test Runs	Data Sheet # 9
9. Pretest Facility Measurements	Individual Test Runs	Data Sheets # 8, 16
10. Test Fuel Measurements		
A. Load Weight.	Individual Test Runs	Data Sheet # 8
B. Load Moisture	Individual Test Runs	Data Sheet # 10
C. Wood Density	Individual Test Runs	Data Sheet # 11
11. Test Fuel Crib Description		
A. Photographs	End	
B. Wood Type	Individual Test Runs	Data Sheet # 9
12. Test Run Heater Operation and Air Supply Settings	Individual Test Runs	Data Sheets # 9 & 13
13. Detailed Description of Sampling Systems and Locations		
A. Method 5H	Appendix B	
B. Proportional Gas Flow Rate System	Appendix B	
C. Stack Gas Flow Rate Measurement System	Appendix B	
14. Calibrations		
A. Platform Scale		
1. Initial	Cal Data	Page 1
2. Semi-Annual	Cal Data	Pages 2-4
3. Pre and Post Test	Individual Test Runs	Data Sheet # 16
B. Analytical Balance		
1. Initial	Cal Data	Pages 5-8
2. Semi Annual	Cal Data	Pages 9 & 10
3. Pre and Post Weighing Check	Individual Test Runs	Data Sheet # 4
C. Temperature		
1. Thermocouples	Cal Data	Page 11
2. Thermocouple Readout		
a. Semi Annual	Cal Data	Page 12
b. Daily Check	Individual Test Runs	Data Sheet # 16
3. Dry Gas Meter	Cal Data	Page 13
4. Tracer Gas Meter	Cal Data	Page 13
D. Anemometer		
1. Initial	Cal Data	Page 14
2. Semi Annual	Cal Data	Page 14
E. Barometer	Cal Data	Page 14
F. Draft Gauge	Cal Data	Page 14
G. Humidity Gauge Calibration (Sling Psychrometer)	Cal Data	Page 13
H. Dry Gas Meter		
1. Semi Annual	Cal Data	Page 15

2. Post Certification Test	Cal Data	Pages 16 & 17
3. Transfer Standard Calibration	Cal Data	Pages 18-23
4. Wet Test Meter Calibration	Cal Data	Page 24
I. Tracer Gas Rotameter	Cal Data	Pages 25-26
J. Combustion Gas (CO_2, O_2, CO) Train Response Check	Cal Data	Page 27
K. Tracer Gas (SO_2) Train Response Check	Cal Data	Page 27
L. CO Analyzer		
1. Calibration	Cal Data	Pages 28 & 29
2. Zero/Span Control Chart	Cal Data	Page 30
3. Pre and Post Test Zero/Span	Individual Test Runs	Data Sheet # 15-3
M. CO_2 Analyzer		
1. Calibration	Cal Data	Pages 31 & 32
2. Zero/Span Control Chart	Cal Data	Page 33
3. Pre and Post Test Zero/Span	Individual Test Runs	Data Sheet # 15-1
N. O_2 Analyzer (Optional)		
1. Calibration	Cal Data	Pages 34 & 35
2. Zero/Span Control Chart	Cal Data	Page 36
3. Pre and Post Test Zero/Span	Individual Test Runs	Data Sheet # 15-2
O. SO_2 Analyzer		
1. Calibration	Cal Data	Pages 37 & 38
2. Zero/Span Control Chart	Cal Data	Page 39
3. Pre and Post Test Zero/Span	Individual Test Runs	Data Sheet # 15-4
P. Calibration Gas Certificates of Analysis		
1. Pre and Post Test Zero/Span Audits	Individual Test Runs	Data Sheets #15-1 - 15-4
2. Method 3 Verification of Analysis (CO_2, O_2, CO, N_2)	Cal Data	Varies
3. Method 6 Verification of Analysis (SO_2, N_2)	Cal Data	Varies
15. Quality Checks		
A. Leak Checks		
1. Particulate Sampling Train	Individual Test Runs	Data Sheet #2
2. SO_2 Injection System	Individual Test Runs	Data Sheet #16
3. Combustion Gas (CO_2, O_2, CO) (CEM) Train	Individual Test Runs	Data Sheet #16
4. Tracer Gas (SO_2) Train	Individual Test Runs	Data Sheet #16
B. Proportional Checks	Individual Test Runs	Table 5-Computer Printout
16. Sample Calculations		
A. Weighted Average Emission Rate	Data Summary	Weighted Average Calc Sheet
B. Dry Burn Rate	Individual Test Runs	Data Sheet # 8
C. [Vm] - [Vm (std)]	Individual Test Runs	Data Sheet # 7 (Particulate Calc Sheet)
D. Total Gas Flow Rate (Qsd)	Individual Test Runs	Table 4-Computer Printout
E. Proportionality Rate (PR)	Individual Test Runs	Table 5-Computer Printout
F. Particulate Emission Rate	Individual Test Runs	Table 4-Computer Printout
17. Raw Test Data	Individual Test Runs	Data Sheets # 1-16
18. Analytical Data		
A. Filter and Beaker Tares	Individual Test Runs	Data Sheets # 4-1, 4-2
B. Solvent Blanks	Individual Test Runs	Data Sheet # 5
C. Particulate Catches		
1. Gross	Individual Test Runs	Data Sheet # 3
2. Blanks	Individual Test Runs	Data Sheets # 5 & 6
3. Net	Individual Test Runs	Data Sheet # 6
4. Gr/dscf	Individual Test Runs	Data Sheet # 7
D. Constant Weight Weighing	Individual Test Runs	Data Sheet # 4-3

M-5H INDIVIDUAL TEST RUN PAGE INDEX

The data sheets in the individual test runs are organized in the following sequence:

A. Computer Printouts

Table 1	Field Data
Table 2	Field Data
Table 3	Field Data Averages
Table 4	Calculations
Table 5	Proportional Rate Variation

B. Raw Data Sheets

		No. of Pages
Data Sheet # 1	Computer Input Data	1
Data Sheet # 2	Meter box Data Sheets	variable
Data Sheet # 3	Moisture /Pariculate Catch Processing Sheet (Front Half, Back Half)	1
Data Sheet # 4-1	Initial Filter Weights	variable
# 4-2	Initial Beaker Weights	variable
# 4-3	Constant Weights	variable
# 4-4	Scale QA Checks	variable
Data Sheet # 5	Blank Catch	1
Data Sheet # 6	Net Particulate Catch Calc Sheet	1
Data Sheet # 7	Particulate Calc Sheet	1
Data Sheet # 8	Miscellaneous Test Data	1
Data Sheet # 9	Stove Operating Data	1
Data Sheet # 10	Fuel Moisture	1
Data Sheet # 11	Wood Density	1
Data Sheet # 12	Burn Rate And Flue Gas Data	variable
Data Sheet # 13	Pre Burn Data	variable
Data Sheet # 14	Temperature Data	variable
Data Sheet # 15	Pre and Post test Zero/Span Audits	1
# 15-1	CO_2	1
# 15-2	O_2	1
# 15-3	CO	1
# 15-4	SO_2	1
Data Sheet # 16	Quality Checks	1

TEST SERIES INFORMATION

Unit name and model number: F370

Type of unit: Wood Heater

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

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

Observers: None

Date Received: 8/7/2008 Aged:8/29-9/2/2008 Dates Tested: 10/1-6/2008

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

Test Location: 13235 Prairie Circle East
Bonney Lake, WA 98391
Test Site Elevation: 500 feet above sea level

LoKee's Field Team

Team Members: Chip Wadington

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

STOVE STORAGE INFORMATION

1. **Temporary Storage at LoKee**

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

2. **Permanent Storage**

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

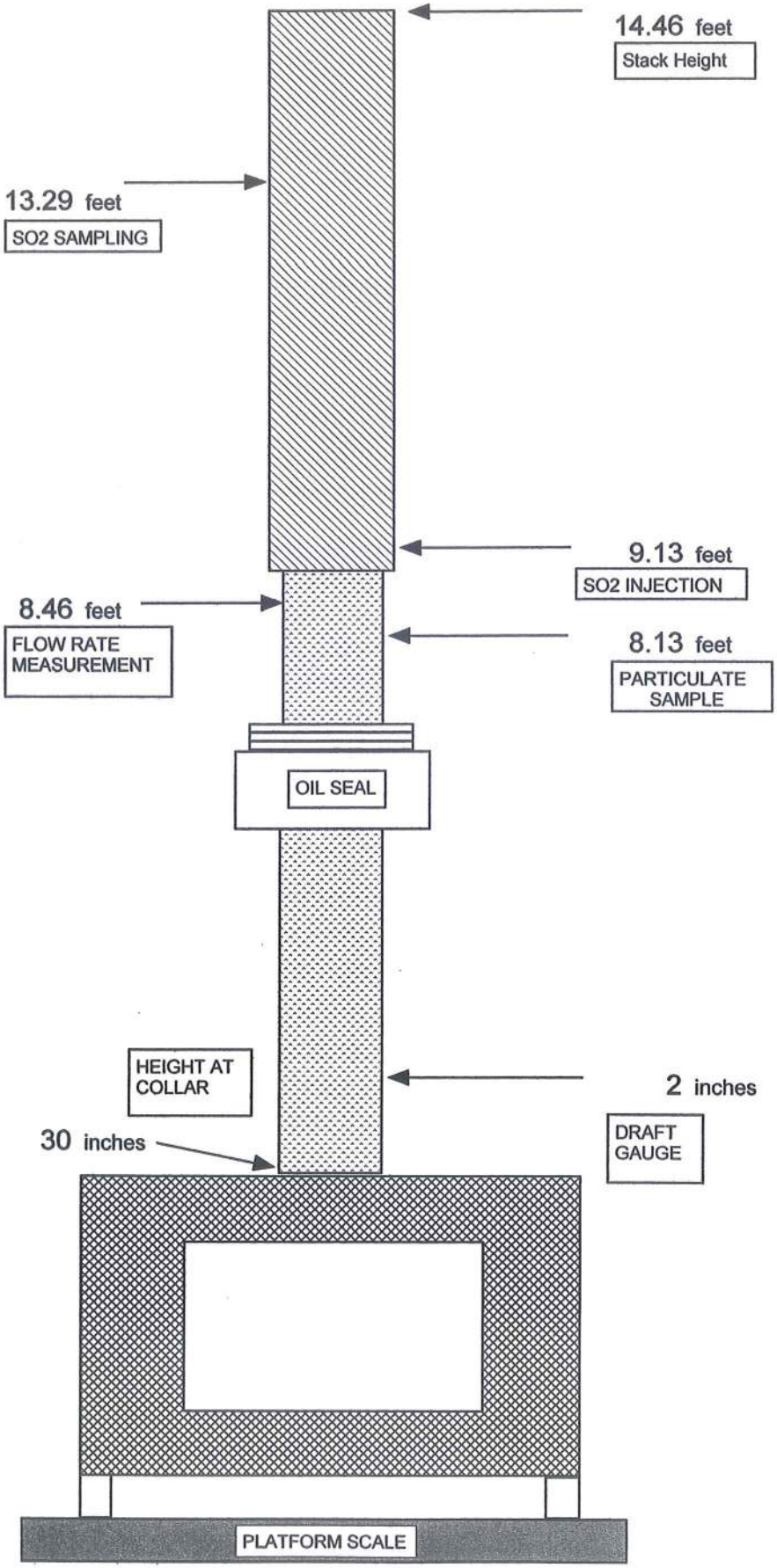
WARNING

SEALED EPA TEST UNIT

DO NOT TAMPER WITH SEALS
TO DO SO WILL VOID CERTIFICATION

JOTUL NORTH AMERICA
F370

Model: Jotul F370 **Date:** 10/01/08



AGING DATA SHEET

UNIT : Jotul F370 DATE: 8-29-08

Hr #	DATE	TIME	TEMP Top 1	TEMP Bot 2
1	8-29-08	1035	671	260
2	"	1135	374	274
3	"	1235	496	254
4	8-30-08	1150	517	238
5	"	1250	340	268
6	"	1350	553	212
7	"	1450	348	192
8	"	1550	276	190
9	8-31-08	1115	306	283
10	"	1215	528	217
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:

LOKEE TESTING Laboratory

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

September 30, 2008

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

Mr. Dupree:

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

Jotul North America:
Model:F370

If you have any questions please feel free to call.

Sincerely,

Chip Wadington
Owner

LOKEE TESTING Laboratory

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

September 30, 2008

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

Mr. Dupree:

On September 30, 2008 at 1:20 pm PST, Irvin Keefer waived the 30 day intent to certify notice at the request of LoKee Testing Laboratory in order to run certification tests on the:

Jotul North America :
Model F370

If you have any questions please feel free to call.

Sincerely,

Chip Wadington
Owner

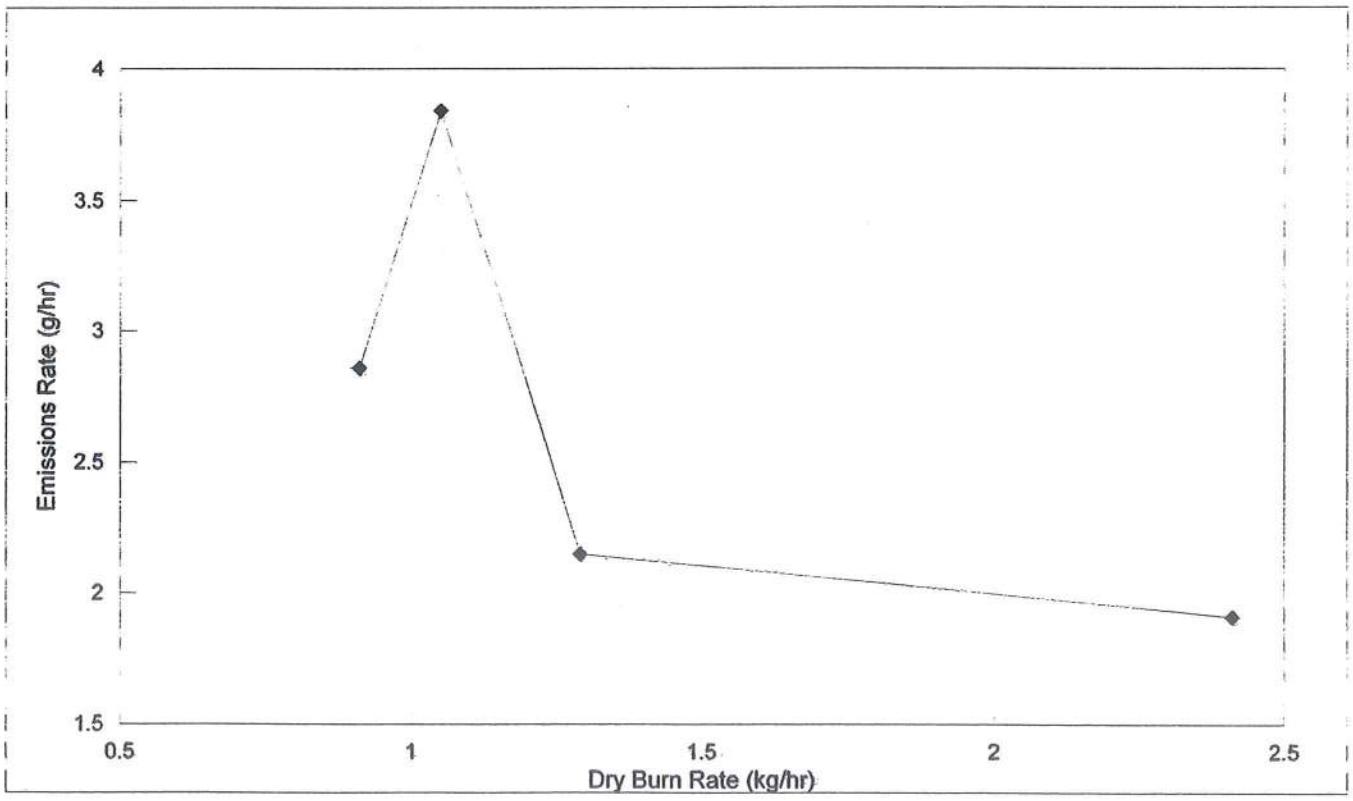
Data
Summary

Wood Heater Emission Test Summary

Laboratory/Wood Heater Information

Stove Manufacturer:	Jotul
Model Identification:	F370
Stove Type> 1=cat, 2=noncat, 3=pellet:	2
Laboratory Name:	LoKee Testing
Laboratory Contact:	CHIP WADINGTON
Telephone no.:	360-897-9685
Test Dates:	10/1-6/2008
Test Methods Used	
Method 28/Other:	28
Sampling Method:	5H

Run no.	Burn Rate (kg/hr)	Emission Rate (g/hr)	Heat Output (Btu/hr)	Wtd Avg (g/hr) 2.58
2	0.91	2.86	10973	
1	1.05	3.84	12661	
4	1.29	2.15	15555	
3	2.41	1.91	29048	



DATA SUMMARY

Unit: Jotul. – Model F370

	RUN #	2	1	4	3				
Particulate Emissions:									
Concentration:	grains/dscf:	.0806	.0995	.0493	.0305				
Emissions Rate	grams/hr:	2.86	3.84	2.15	1.91				
Emissions Factor	grams/kg:	3.13	3.66	1.67	0.79				
Front Half Catch	% of total	22.8	31.8	40.2	44.0				
Total Mass Captured	total catch:	.3646	.3044	.1648	.0487				
Heat Output (EPA Default):	BTU/hr	11009.1	12662.5	15531.0	29048.2				
Fuel Burn Rates:									
Average kg/hr (dry)	Kg/hr	.91	1.05	1.29	2.41				
Fuel Moisture Content:									
Kindling (wet basis)	%	13.867	12.075	13.270	13.743				
Pretest Fuel (wet basis)	%	17.196	16.365	17.150	16.493				
Test Fuel (wet basis)	%	16.166	16.400	16.805	18.234				
Air to Fuel Ratio		-	-	-	-				
Average Stack Gas									
Avg CO_2	%	4.26	4.58	5.26	7.5				
Avg O_2	%	-	-	-	-				
Avg CO	%	.44	.46	.32	.15				
Avg Moisture	%	4.79	4.76	5.72	10.4				
Avg Stack Gas Emissions:									
CO	g/Kg	87.49	86.75	55.61	20.1				
	g/hr	79.88	91.09	71.62	48.42				

Unit: Jotul – Model F370

	RUN #	2	1	4	3				
Avg Stack Gas Flow Rate									
EPA CMB	dscfm	9.12	9.92	11.21	16.12				
Tracer Gas	dscfm	8.161	8.296	8.721	12.949				
Draft (static)	in H_2O	-.039	-.045	-.050	-.062				
Proportionality Average	%	100	100	100	100	100	100	100	100
Average Temperatures									
Stack Gas	°F	292	302	364	587				
Firebox	°F	-	-	-	-				
Secondary	°F	-	-	-	-				
Catalytic Combustor	°F	-	-	-	-				
Top	°F	372	375	438	610				
Left Side	°F	220	232	252	323				
Back	°F	244	258	281	357378				
Right Side	°F	241	253	271	279357				
Bottom	°F	197	201	221	279				
Temperature Change	°F	-46.0	-25.8	-37.6	-50.3				
Test Chamber Enviroment									
Average Barometer	in. Hg	29.81	29.93	30.06	29.66				
Average Temperature	°F	75	80	74	79				
Ambient Moisture	% H_2O	1.75	1.9	1.75	1.75				
Relative Humidity	%RH	57	55	57	47				
Air Velocity	m/sec	0	0	0	0	0	0	0	0
Fuel Weight and Burn Time									
Density (dry basis)	gm/cm^3	-	-	-	-				
Coal Bed Weight	lbs	2.1	2.2	1.9	2.0				
Pre Test Fuel (inc kindling)	lbs	24.5	28.8	22.4	23.0				
Test Fuel	lbs	9.6	9.0	9.1	9.2				
Burn Time	min	240	195	160	85				

MAXIMUM
DBR

2.409 / 1.91

TABLE 1 ----- RAW DATA

CLIENT : Jotul

TEST No. : 3

MODEL: F370

DATE: 03-Oct-2008

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	273.000	0.150	79	0.01	6.00	275
5	274.500	0.130	80	0.09	16.10	300
10	275.915	0.080	80	0.07	15.30	375
15	277.047	0.080	82	0.09	14.50	375
20	278.188	0.110	82	0.05	14.70	325
25	279.504	0.150	82	0.11	11.40	275
30	281.059	0.150	82	0.04	8.70	275
35	282.614	0.180	82	0.05	5.30	250
40	284.324	0.180	82	0.08	5.10	250
45	286.034	0.180	82	0.14	5.20	250
50	287.744	0.180	82	0.18	5.00	250
55	289.454	0.180	82	0.23	5.00	250
60	291.164	0.180	82	0.21	4.80	250
65	292.881	0.180	83	0.23	4.10	250
70	294.597	0.180	83	0.25	3.90	250
75	296.314	0.220	83	0.29	3.60	225
80	298.221	0.220	83	0.28	3.30	225
85	300.128	0.220	83	0.29	3.00	225

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 3

MODEL: F370 DATE: 03-Oct-2008

****

METER CAL. FACTOR (Y) -------	0.94		Wt. WOOD BURNED(LB) -------	9.2	Lbs
BAROMETRIC PRESS.(Pb) -------	29.66	in Hg	WET,FUEL MOISTURE % -------	18.234	%
LEAK RATE POST (Lp) -------	0.000	cfm	Wt. PART. COLLECTED -------	0.0487	g
WATER VOL. (V1c) -------	60.8	Ml	METER VOLUME Vm -------	27.128	mcf
TEST TIME (MIN) -------	85	min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 3

MODEL: F370 DATE: 03-Oct-2008

****

AVG DELTA H	-------	0.16 in H2O		AVG PRCNT CO	-------	0.15	%
AVG METER TEMP. Tm	-------	82 deg F		AVG PRCNT CO2	-------	7.50	%
AVG PPM SO2	-------	271	PPM	AVG BAL CO2/CO	-------	50.19	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 3

MODEL: F370 DATE: 03-Oct-2008

****

STD SAMPLE VOL. Vm(std) d) ------	24.65 dscf	STACK GAS FLOW Qsd -------	967.447	dscf/Hr &
			16.12	dscf/min
VOL. WATER VAPOR Vw(s td) -----	2.862 scf	PARTICULATE CONCTRT. C s ------	0.0020	g/dscf
PRCNT MSTR Bws -------	10.40 %	PARTC.EMISS. RATE E -------	1.91	g/Hr
BURN RATE BR -------	2.41 Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.47	Lb-mole/Lb
CO EMISSION RATE -------	48.42 g/Hr &	PART.EMISS. RATE ------	0.79	g/Kgdry fuel
	20.10 g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 3

MODEL: F370 DATE: 03-Oct-2008

	TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR		PROPRTN RATE VAR. AVERAGE
	5	376.4	97		100
	10	387.0	100		
	15	386.2	100		
	20	388.6	100		
	25	388.4	100		
	30	388.4	100		
	35	388.4	100		
	40	388.3	100		
	45	388.3	100		
	50	388.3	100		
	55	388.3	100		
	60	388.3	100		
	65	389.5	100		
	70	389.0	100		
	75	389.2	100		
	80	389.1	100		
	85	389.1	100		
	90				

COMPUTER INPUT DATA SHEET #1

Client: Jotul North America

Address: 55 Hutcherson
Gorham, ME 04038

Phone: 800-797-5912 Fax: 207-591-6623 18

Run No.: 3 Date of Test: 10-3-2008 Burn Rate: 2.409

Model No.: F370 ☐ min ☐ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .940 (0.000) (Data Sheet #2) Post Leak Rate: 0.00 cfm (.000) (Data Sheet #2) Time: 95 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 27.128 cf (00.000) (Data Sheet #2)

Stack Flow: 12.949 dscfm (00.000) (Data Sheet #2) Δ H: .164 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 2.0 (0.0) (Data Sheet #2) Barometric Pressure: 29.66 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 60.8 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 44.6 % (00.0) (Data Sheet #6) Total Particulate Catch: .0487 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 7.8551 % (00.000) (Data Sheet #7)

Particulate Emission: .0305 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 47.0 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.75 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 23.0 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 2.0 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 9.2 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 29048.2 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 13.743 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 16.493 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 22.300 % Test Fuel % Moisture (wet): 18.234 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove])

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

Stack Static Pressure: -.062 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 79 °F (00) (Data Sheet #14) Stove Temperature Change: -50.3 °F (+/- 000.0) (Data Sheet #14)

Test start = 1050

Test End = 1215

meter Temp = 542

METER BOX DATA SHEET PAGE # 2

Page: 1 of 1

UNIT: Jotul F370 RUN: 3 DATE: 10-3-2008

Meter Box: 5H Y Factor: .940

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

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

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

ROTO: PRESS: .18			SAMPLING RATIO: 41 : 1				BP: 29.66		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1050	273.000	—	12.537	.15	79	275	79	2.0
5	55	274.500	—	11.471	.13	80	300	80	2.0
10	1100	275.915	275.915	9.177	.08	80	375	80	2.0
15	05	277.047	277.047	9.143	.08	82	375	82	2.0
20	10	278.188	278.188	10.549	.11	82	325	82	2.0
25	15	279.504	279.504	12.467	.15	82	275	82	2.0
30	20	281.059	281.059	12.467	.15	82	275	82	2.0
35	25	282.614	282.614	13.714	.18	82	250	82	2.0
40	30	284.324	284.324	13.714	.18	82	250	82	2.0
45	35	286.034	286.034	13.714	.18	82	250	82	2.0
50	40	287.744	287.744	13.714	.18	82	250	82	2.0
55	45	289.454	289.454	13.714	.18	82	250	82	2.0
ROTO PRESS: .18			TOTALS:	146.381	1.75	977	BP.: 29.66		
60	1150	291.164	291.164	13.689	.18	83	250	83	2.0
65	55	292.881	292.881	13.689	.18	83	250	83	2.0
70	1200	294.597	294.597	13.689	.18	83	250	83	2.0
75	05	296.314	296.314	15.210	.22	83	225	83	2.0
80	10	298.221	298.221	15.210	.22	83	225	83	2.0
85	15	300.128	300.128	15.210	.22	83	225	83	2.0
90				86.687	1.20	498			
95									
100									
105									
110									
115						1475			
			TOTALS:	233.078	2.95	82	MAX VACC =		2.0
TOTAL Cu Ft.		27.128	TOTALS:	12.949	.164	542	AVG. BP:		29.66

÷18

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F370 RUN : 3 DATE : 10-3-08

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	638.3	584.7	485.8	854.1
INITIAL WT	606.5	583.2	484.7	827.7
NET WT GRAMS	31.8	1.5	1.1	26.4

TOTAL CATCH : 60.8 GRAMS H_2O

FRONT HALF

FILTER #	153F	
FINAL WT g	.6745	
INITIAL WT g	.6591	
NET WT g	.0154	

BEAKER #	106
DESC.	ACETONE
FINAL WT g	96.7167
INITIAL WT g	96.7100
NET WT g	.0067
VOL. DESC. ml	50

BACK HALF

FILTER #	153B	
FINAL WT g	.3660	
INITIAL WT g	.3620	
NET WT g	.0040	

BEAKER #	107	108	109	110	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	107.3570	104.9503	98.8698	104.0180	
INITIAL WT g	107.3408	104.9468	98.8647	104.0134	
NET WT g	.0162	.0035	.0051	.0046	.0097
VOL. DESC ml	75	75	125	125	250

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 9-5-2008 Time : 1100 By : CP

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : 413903

Back Size: 8.2 cm Lot No. :

	DATE: 9-8-2008	BY: AV	DATE: 9-9-2008	BY: AV	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
151F	0.6612	0939	0.6610	1002	✓	
152F	0.6600	0940	0.6600	1003	✓	
153F	0.6592	0941	0.6591	1004	✓ F370 R-3	
154F	0.6606	0942	0.6605	1005	✓	
155F	0.6613	0943	0.6613	1006	✓	
156F	0.6603	0944	0.6601	1007	✓	
157F	0.6631	0945	0.6631	1008	✓	
158F	0.6642	0946	0.6641	1009	✓	
159F	0.6620	0947	0.6618	1010	✓	
160F	0.6593	0948	0.6594	1011	✓	
151B	0.3641	0949	0.3641	1012	✓	
152B	0.3603	0950	0.3603	1013	✓	
153B	0.3621	0951	0.3620	1014	✓ F370 R-3	
154B	0.3608	0952	0.3609	1015	✓	
155B	0.3625	0953	0.3625	1016	✓	
156B	0.3648	0954	0.3648	1017	✓	
157B	0.3596	0955	0.3596	1018	✓	
158B	0.3640	0956	0.3639	1019	✓	
159B	0.3630	0957	0.3629	1020	✓	
160B	0.3644	0958	0.3643	1021	✓	

Checked by: C. Wadington Date: 9-10-08 Time: 1055

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
9-8-08	0930	CP		77	49
9-9-08	1000	CP		74	46

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 1-23-2008 Time : 1300 By : CP W

	DATE: 1-31-08	BY: CP	DATE: 2-1-08	BY: CP	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
101	95.5921	1905	95.5917	1536	✓	
102	96.3700	1906	96.3695	1537	✓	
103	102.3542	1907	102.3540	1538	✓	
104	106.2064	1908	106.2059	1539	✓	
105	107.0617	1909	107.0612	1540	✓	
106	96.7103	1910	96.7100	1541	✓	
107	107.3412	1911	107.3408	1542	✓	
108	104.9473	1912	104.9468	1543	✓ F370 R-3	
109	98.8652	1913	98.8647	1544	✓	
110	104.0139	1914	104.0134	1545	✓	
111	97.7420	1915	97.7415	1546	✓	
112	104.8863	1916	104.8859	1547	✓	
113	106.4418	1917	106.4413	1548	✓	
114	106.1925	1918	106.1920	1549	✓	
115	106.8180	1919	106.8175	1550	✓	
116	105.9332	1920	105.9329	1552	✓	
117	103.8876	1921	103.8872	1553	✓	
118	107.1528	1922	107.1523	1554	✓	
119	105.5019	1924	105.5014	1555	✓	
120	106.0900	1925	106.0898	1556	✓	
121	106.3660	1926	106.3656	1557	✓	
122	107.0219	1927	107.0214	1558	✓	
123	108.6517	1928	108.6512	1600	✓	
124	106.2091	1929	106.2087	1601	✓	
125	107.7520	1930	107.7515	1602	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH	
1-31-08	1900	CP		74	44	Checked by : CP W.
2-1-08	1530	CP		76	45	Date : 2-15-08
						Time : 1215

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F370 RUN : 3 DATE : 10-3-08 Page : 1 of

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
106	10-4	1530	CP	96.7191	10-6	0953	CP	96.7162	10-7	1713	CP	96.7167	10-8	1007	CP
107	10-4	1530	CP	107.3595	10-6	0954	CP	107.3566	10-7	1714	CP	107.3570	10-8	1008	CP
108	10-4	1530	CP	104.9525	10-6	0955	CP	104.9498	10-7	1715	CP	104.9503	10-8	1009	CP
109	10-4	1530	CP	98.8728	10-6	0956	CP	98.8694	10-7	1716	CP	98.8698	10-8	1010	CP
110	10-4	1530	CP	104.0214	10-6	0957	CP	104.0176	10-7	1717	CP	104.0180	10-8	1011	CP

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
153F	10-3	1500	CP	.6748	10-4	1600	CP	.6745	10-6	0951	CP				
153B	10-3	1500	CP	.3660	10-4	1600	CP	.3660	10-6	0952	CP				

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	10-4-08	1530	CP	78	46
2	10-6-08	0930	CP	77	49
3	10-7-08	1700	CP	78	49
4	10-8-08	1000	CP	78	49
5					

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 8-27-2008 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	1.0000	.0999	CP	8-27	0900	78	46
100.0001	10.0000	1.0000	.0999	CP	8-28	0930	78	46
100.0001	10.0001	1.0001	.0997	CP	8-29	1300	78	46
100.0000	10.0000	1.0000	.1000	CP	8-30	1030	78	46
100.0001	10.0003	1.0001	.0999	CP	8-31	1015	76	49
100.0000	10.0001	1.0000	.0997	CP	9-1	1100	74	44
100.0000	10.0001	.9999	.1000	CP	9-2	0845	75	48
99.9999	10.0000	.9999	.0998	CP	9-4	1000	77	47
99.9999	10.0002	1.0001	.0999	CP	9-8	0930	77	49
99.9999	9.9999	.9998	.0998	CP	9-9	1000	74	48
99.9997	9.9997	1.0000	.0999	CP	9-11	1500	76	45
100.0000	9.9997	.9999	.0999	CP	9-17	0930	77	49
100.0000	10.0000	1.0000	.0999	CP	9-18	0900	78	46
100.0000	10.0000	.9999	.0999	CP	9-19	0915	78	49
100.0000	10.0000	.9999	.0999	CP	9-22	1030	77	46
100.0000	10.0001	1.0000	.0998	CP	9-24	1330	78	49
100.0001	10.0001	1.0000	.0999	CP	9-25	0930	78	46
100.0000	9.9999	1.0001	.0998	CP	9-26	0920	78	46
100.0001	9.9999	1.0001	.0999	AV	9-29	0955	78	46
100.0000	10.0001	1.0000	.0998	CP	10-2	0945	75	44
100.0000	10.0000	1.0000	.0999	CP	10-3	0930	78	46
100.0000	9.9999	1.0000	.0999	CP	10-4	1530	78	46
100.0000	9.9999	.9999	.0999	CP	10-6	0930	77	49
100.0000	10.0001	1.0002	.1000	CP	10-7	1700	78	49
100.0000	10.0000	1.0000	.0999	CP	10-8	1000	78	49
99.9999	10.0000	1.0001	.0999	CP	10-9	1030	78	43
100.0000	9.9999	1.0001	.1000	CP	10-10	0930	78	40
100.0000	9.9998	.9999	.0997	CP	10-11	1430	74	47
100.0000	10.0001	1.0000	.1000	CP	10-13	0940	78	46
100.0000	10.0000	.9999	.0999	CP	10-14	2030	77	49
100.0000	10.0002	1.0000	.1000	CP	10-16	1220	78	43
100.0000	9.9999	1.0000	.0999	CP	10-18	1130	74	47

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-22-07 Through 8-26-2008	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0000	10.0001	1.0000	.0998	CP	10-22	1630	78	46
99.9999	10.0001	1.0000	.1001	CP	10-23	1000	74	44
100.0002	10.0002	1.0002	.0999	CP	10-24	1400	73	47
100.0002	10.0000	1.0001	.0998	CP	10-26	1700	74	40
100.0003	10.0001	1.0001	.0999	CP	10-27	0820	78	40
99.9999	10.0000	.9999	.0997	CP	10-28	1200	78	40
100.0000	9.9999	.9999	.0999	CP	10-29	1700	76	42
99.9998	9.9999	.9999	.1000	CP	10-30	1600	78	43
99.9997	10.0000	.9999	.0999	CP	11-16	1500	68	47
100.0001	10.0002	1.0000	.0999	CP	11-19	1730	73	40
100.0000	10.0002	.9999	.0999	CP	11-20	1100	69	44
.08 99.9998	9.9999	.9999	.0998	CP	1-18-08	1230	76	45
100.0002	10.0002	.9999	.0999	CP	1-21-08	1430	65	48
99.9999	10.0002	1.0001	.0999	CP	1-22-08	1200	68	47
100.0002	9.9999	.9999	.0998	CP	1-23-08	1400	74	47
99.9999	10.0000	1.0002	.1000	CP	1-31-08	1900	74	44
100.0000	10.0003	1.0000	.0996	CP	2-1-08	1530	76	45
99.9997	9.9999	.9999	.0999	CP	2-16-08	1700	68	47
100.0001	10.0002	1.0000	.1000	CP	2-18-08	1400	72	46
99.9999	10.0001	.9999	.0998	CP	2-22-08	1800	68	47
99.9999	10.0001	1.0000	.0999	CP	2-27-08	1800	78	43
100.0000	10.0000	1.0000	.0999	CP	5-8-08	1030	78	43
100.0001	10.0001	1.0000	.0999	CP	5-9-08	0930	69	47
100.0000	10.0001	.9999	.0999	CP	5-10-08	1330	74	47
99.9998	9.9999	1.0000	.0998	CP	5-11-08	0900	74	44
100.0003	10.0001	.9999	.0998	CP	5-12	1400	70	48
99.9999	10.0001	1.0000	.1000	CP	5-13	1000	77	42
99.9999	9.9997	1.0000	.1000	CP	5-14	1230	77	42
99.9999	10.0001	.9999	.1000	CP	6-5-08	1430	72	46
100.0001	10.0000	1.0000	.0999	CP	6-9-08	1400	74	44
99.9999	9.9999	1.0000	.0999	CP	6-9-08	1800	73	47
100.0001	10.0001	.9999	.0998	CP	8-11-08	0930	77	42
100.0003	10.0000	1.0001	.0999	CP	8-12-08	1011	78	43
100.0000	10.0001	1.0000	.0999	CP	8-13-08	0950	76	49
100.0002	10.0000	1.0000	.0998	CP	8-18-08	0930	74	44
100.0001	9.9999	1.0000	.0998	CP	8-20-08	1110	76	45
100.0000	9.9999	.9999	.0998	CP	8-21-08	0915	75	48
100.0002	10.0000	1.0000	.1002	CP	8-22-08	0910	75	45
100.0000	10.0001	1.0001	.0999	CP	8-26-08	0900	78	43

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-26-2007 Through 10-14-2007	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9997	10.0001	1.0001	.0999	CP	4-26	0815	73	47
100.0002	10.0001	1.0000	.0999	CP	4-27	1400	78	46
99.9999	10.0000	1.0000	.1000	CP	4-29	1100	74	44
100.0003	10.0001	.9999	.1000	CP	5-1	1000	71	45
100.0003	10.0001	.9999	.1000	CP	5-7	1530	76	45
100.0001	9.9999	1.0000	.1000	CP	5-9	1400	78	46
100.0001	10.0000	1.0000	.0998	CP	5-13	1630	76	45
100.0002	10.0001	1.0000	.1000	CP	5-18	1350	77	46
100.0003	10.0001	1.0000	.0998	CP	5-21	1300	72	46
99.9999	10.0001	1.0000	.1000	CP	5-22	1600	78	46
99.9999	10.0001	1.0000	.0996	CP	6-5	1530	74	44
100.0000	10.0001	.9998	.0999	CP	6-7	1030	70	48
100.0000	10.0001	1.0000	.1000	CP	6-8	1000	68	47
99.9998	10.0004	1.0000	.1000	CP	6-9	1300	78	40
99.9997	10.0000	1.0000	.1000	CP	6-10	1530	78	49
100.0003	10.0002	1.0000	.0998	CP	6-11	0900	72	46
99.9998	10.0000	.9999	.0998	CP	6-12	2100	78	40
99.9998	9.9998	1.0000	.0998	CP	6-13	1600	74	47
99.9999	9.9999	1.0000	.0999	CP	6-14	1630	77	49
99.9999	10.0000	1.0000	.1000	CP	6-15	1430	75	48
100.0001	10.0007	1.0001	.1000	CP	6-19	1040	78	46
100.0000	10.0001	.9999	.0997	CP	6-20	1050	75	48
99.9996	9.9998	.9999	.0998	CP	8-29	1830	74	48
100.0002	10.0002	1.0001	.0999	CP	8-31	1000	78	46
99.9999	10.0002	1.0001	.1000	CP	9-1	1130	77	46
99.9999	10.0001	.9999	.0999	CP	9-4	1100	78	43
99.9997	9.9999	.9998	.0998	CP	9-5	1000	78	46
100.0000	10.0000	.9999	.0999	CP	9-6	1500	78	46
99.9997	10.0000	1.0000	.1000	CP	9-7	1745	78	43
100.0001	10.0000	1.0000	.0997	CP	9-8	1500	78	46
100.0002	10.0000	.9999	.1000	CP	10-5	0930	75	48
100.0003	10.0003	1.0000	.0999	CP	10-6	1400	78	46
100.0001	10.0000	1.0000	.0999	CP	10-8	1000	75	44
100.0002	10.0001	1.0000	.0999	CP	10-9	1130	78	46
100.0001	10.0002	.9999	.0997	CP	10-10	1500	74	44
99.9999	10.0000	1.0001	.0999	CP	10-11	1120	75	48
100.0000	9.9999	.9999	.0998	CP	10-12	1130	72	45
100.0003	9.9999	1.0000	.1000	CP	10-13	1030	78	46
99.9999	10.0000	1.0000	.1000	CP	10-14	1400	78	46

BLANK PROCESSING DATA SHEET # 5

UNIT : _____ RUN : _____ DATE : _____

BLANKS DONE : 10-30-2007

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT #023283	FISHER OPTIMA LOT #035941	DWNA Inc Sparklettes Distilled
FINAL WEIGHT	108.9009	106.3077	106.9680
TARE WEIGHT	108.8995	106.3063	106.9644
NET WEIGHT	.0014	.0014	.0036

TARE BEAKERS INTO DESC : TIME : 1700 DATE : 10-20-07

DATE : 1022 BY : Cp DATE : 1023 BY Cp DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8994	1700	108.8995	1027		
B	106.3060	1701	106.3063	1028		
C	106.9639	1702	106.9644	1029		

FINAL BEAKERS INTO DESC : TIME : 1040 DATE : 10-27-07

DATE : 1029 BY : Cp DATE : 1030 BY Cp DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9011	1721	108.9009	1619		
B	106.3074	1722	106.3077	1621		
C	106.9678	1723	106.9680	1622		

TARE QC

DATE	TIME	BY	WB	DB	%
10-22	1630	Cp	S	78	46
10-23	1000	Cp		74	44

FINAL QC

DATE	TIME	BY	WB	DB	%
10-29	1700	Cp	S	76	42
10-30	1600	Cp		78	43

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: F370 RUN: 3 DATE: 10-3-08

BLANK CALCULATIONS

Acetone :	.0014	g ÷	200	ml =	.000007	g/ml
Dicholoromethane :	.0014	g ÷	75	ml =	.000019	g/ml
Distilled Water :	.0036	g ÷	200	ml =	.000018	g/ml

FRONT HALF CATCH

FILTERS: .0154 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0154 g

BEAKERS: .0067 (Total Catch) g - 50 (ml Acetone) (.000007 g) (Blank Value / ml Acetone) = .0063 g

.0004

TOTAL FRONT HALF CATCH : .0217 g

BACK HALF CATCH

FILTERS: .0040 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0040 g

BEAKERS:

Acetone: .0162 (Total Catch) g - 75 (ml Acetone) (.000007 g) (Blank Value / ml Acetone) = .0157 g

.0005

Extract: .0035 (Total Catch) g - 75 (ml Dichloromethane) (.000019 g) (Blank Value / Dichloromethane) = .0021 g

(.0014)

Water: .0097 (Total Catch) g - 250 (ml Water) (.000018 g) (Blank Value / Water) = .0052 g

.0045

TOTAL BACK HALF CATCH : .0270 g

TOTAL CATCH : .0487 g

% FRONT HALF : 44.6 %

CALCULATIONS DATA SHEET # 7

UNIT: Jotul F370 RUN: 3 DATE: 10-3-2008

1) Vm (std) = $\dfrac{(27.128 \text{ Vm})(17.64)(.940 \text{ mcf})\left(29.66'' \text{ Hg} + \dfrac{.164'' \text{ H}_2\text{O}}{13.6}\right)}{(542 \text{ TmA})}$ = 24.6259 / 000.0000 dscf

2) Vw (std) = (.04707)(44.6 ml H_2O) = 2.0993 / 00.0000 scf

3) Asw = $\dfrac{(2.0993 \text{ scf})}{(2.0993 \text{ scf} + 24.6259 \text{ dscf})}$ = .0786 / .0000 Bws × 100 = 7.8551 / 00.0000 % H_2O

4) Cs = $\dfrac{(.0487 \text{ g.})}{(24.6259 \text{ dscf})}$ (15.43) = .0305 / 0.0000 gr / dscf

5) Estimated g / hr = $\dfrac{(.0487 \text{ g.})}{(24.6259 \text{ dscf})}$ (12.949 / 00.0000 dscfm)(60) = 1.5365 / 00.0000 g / hr

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

TEST DATA SHEET # 8

UNIT: Jotul F370 RUN: 3 DATE: 10-3-2008

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

Wet Bulb / Dry Bulb

Pre : WB: 69 DB: 83 = 48.0 % RH 1.8 % H_2O

Post : WB: 68 DB: 83 = 46.0 % RH 1.7 % H_2O

Average: 47.0 % RH 1.75 % H_2O

Empty Stove Weight (lbs): N/A w/ stack & oil seal : Wet: N/A Dry: 367.6

Kindling Weight (lbs): Paper: .1 Wood: 1.7

Preburn Fuel Weight: 12.7 + 8.6 Total: 21.3

Kindling & Preburn Fuel Weight (wood only) (lbs): Total: 23.0

Coal Bed Wt Range (lbs): 2.3 - 1.9 **Scale:** 369.9 - 369.5

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

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

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

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

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" x 4"	8	3	ALL	100 %
2" x 4"	12.5	3	2"x4"s	

Test Fuel Weight: 9.2 lbs

Estimated Dry Burn Rate:

$$\frac{9.2 - (9.2 \times .18234)}{2.2046} \times \frac{60}{\frac{85}{\text{TIME}}} = 2.409 \text{ kg/hr}$$

Estimated BTU's/hr: 19,140 × $\frac{63}{100}$ × $\frac{2.409}{\text{DBR}}$ = 29048.2 BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : Jotul F370 Run : 3 Date : 10-3-2008

FIRE STARTED: 0840

WARM UP AND PREBURN:

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

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

CHARCOAL BED PREPARATION :

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

TEST:

DOOR wide open during loading Ø min. 45 sec.

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

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

NO **FAN:**

~~ON / OFF during warm-up~~ ~~ON / OFF during preburn~~

~~ON / OFF first _____ minutes of test~~ ~~ON / OFF balance of test run~~

~~Fan speed set at _____~~

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 X inches.

1st warm up / pre-burn fuel charge (12.7 lbs.) added at 0850

2nd warm up / pre-burn fuel charge (8.6 lbs.) added at 0945

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

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

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

TEST DATA SHEET #10

Unit : Jutul F370 Run : 3 Date : 10- 3 -2008

Room Temperature : 72 °F Temperature Correction Set?: YES NO

Calibration Check : 12.0% + or- 0.2%? YES NO

Time Test Fuel moisture reading taken : 1030

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Average
1	2"×4"×8'	K	15.7	16.1	16.0	15.933
2						
3						
4	2"×4"×8'	P	12.9	18.4	18.7	18.3
5	2"×4"×8'	P	22.2	19.9	21.5	21.2
6	2"×4"×8'	P				39.5
7	2"×4"×8'	P				
8	2"×4"×8'	P				
9						
10						
11	2x4x8"	T	22.7	21.9	22.4	22.3
12	"	T	22.4	22.5	22.5	22.5
13	"	T	21.9	22.5	22.5	22.3
14	2x4x12.5"	T	21.5	21.9	21.6	21.7
15	"	T	23.0	22.7	22.7	22.8
16	"	T	22.3	22.0	22.2	22.2
17						133.8
18						
19						
20	Spacers	T	21.7	21.2	21.4	21.433

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	15.933 %	19.750 %	22.300 %
Wet Moisture % :	13.743 %	16.493 %	18.234 %

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 with meter corrected for temperature.

GAS DATA SHEET #12

WEIGHT: 369.6

DATE: 10-3-2008

UNIT: Jotol F370

RUN: 3

PAGE: 1 OF 1

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2 PPM
0 / 1050	378.8	9.2	—	.243	6.0	.580	14.7	.000	.01	-.060	275
5 / 55	377.4	7.8	1.4	.643	16.1	.185	4.6	.008	.09	-.074	300
10 / 1100	376.0	6.4	1.4	.611	15.3	.217	5.4	.006	.07	-.076	375
15 / 05	374.4	4.8	1.6	.580	14.5	.248	6.2	.008	.09	-.077	375
20 / 10	373.0	3.4	1.4	.590	14.7	.240	6.0	.004	.05	-.078	325
25 / 15	371.7	2.1	1.3	.456	11.4	.376	9.4	.010	.11	-.075	275
30 / 20	371.1	1.5	.6	.349	8.7	.480	12.0	.003	.04	-.071	275
35 / 25	370.9	1.3	.2	.213	5.3	.615	15.4	.004	.05	-.065	250
40 / 30	370.7	1.1	.2	.206	5.1	.627	15.7	.007	.08	-.060	250
45 / 35	370.6	1.0	.1	.210	5.2	.623	15.6	.013	.14	-.060	250
50 / 40	370.4	.8	.2	.204	5.0	.623	15.6	.017	.18	-.059	250
55 / 45	370.3	.7	.1	.204	5.0	.619	15.5	.022	.23	-.056	250
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.811	*****
60 / 50	370.1	.5	.2	.195	4.8	.627	15.7	.020	.21	-.055	250
65 / 55	370.0	.4	.1	.165	4.1	.655	16.4	.022	.23	-.054	250
70 / 1200	369.9	.3	.1	.158	3.9	.663	16.6	.024	.25	-.053	250
75 / 05	369.8	.2	.1	.148	3.6	.675	16.9	.028	.29	-.051	225
80 / 10	369.7	.1	.1	.134	3.3	.687	17.2	.027	.28	-.050	225
85 / 15	369.6	.0	.1	.122	3.0	.699	17.5	.028	.29	-.050	225
90 / 20											
95 / 25										-.313	
100 / 30											
105 / 35											
110 / 40											
115 / 45											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
120 / 50											
125 / 55											
130 / 1300											
135 / 05											
140 / 10											
145 / 15											
150 / 20											
155 / 25											
160 / 30											
165 / 35											
170 / 40											
175 / 45											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.124	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.062	*****

NO Fan?

...EBURN DATA SHEET #15

UNIT: Jotul F370 RUN: 3 DATE: 10-3-2008 PAGE: 1 of

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 / 0950	376.9	—	511	478	249	283	293	202			68	-062	PREBURN START: # UP
5 / 55	375.5	1.4	764	602	250	289	299	215			69	-071	COAL BED SCALE RANGE:
10 / 1100	374.2	1.3	754	702	254	305	308	228			68	-072	369.9 to 369.5
15 / 05	373.0	1.2	722	722	260	323	318	237			69	-071	PRIMARY AIR: wide open
20 / 10	372.0	1.0	685	724	269	340	329	245			70	-070	SECONDARY AIR: N/A
25 / 15	371.0	1.0	682	704	281	355	343	260			73	-067	FAN: NONE
30 / 20	370.3	.7	609	686	292	367	353	268			76	-066	PUMPS ON AT:
35 / 25	369.9	.4	525	619	304	375	361	276			76	-063	CHECK WB/DB: N/A
40 / 30	369.7	.2	475	572	309	376	363	280			78	-059	added 1.2 lbs
370.9 45 / 35	370.6	.3	567	546	312	372	361	281			78	-063	
50 / 40	370.2	.4	536	557	314	370	359	286			78	-061	
55 / 45	369.8	.4	519	545	313	367	357	291			78	-060	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 / 50	369.6	.2	434	526	315	366	357	294			79	-060	
65 / 55													
70													
75													
80													

Jotul F370

Temperature Data Sheet 14

Run 3
10/03/2008

Time	Stack	Top	LT Side	Back	Rt Side	Bottom	Firebox	Sec/Cat	Ambient	Tube Furn	Smpl Box	Smpl Out	C-Gas Box	C-Gas Out	SO2 Out
*********	Chn 103	Chn 104	Chn 105	Chn 106	Chn 107	Chn 108	Chn 109	Chn 110	Chn 111	Chn 112	Chn 113	Chn 114	Chn 115	Chn 116	Chn 117
0	434	526	315	366	357	294	#####	#####	79	1269	230	48	230	31	35
5	964	553	312	358	351	301	#####	#####	78	1278	231	41	231	33	36
10	998	736	308	358	344	303	#####	#####	79	1285	232	42	238	35	37
15	963	823	309	371	344	299	#####	#####	80	1293	235	41	245	36	38
20	970	860	315	389	352	295	#####	#####	80	1307	238	41	248	37	38
25	831	877	325	410	366	289	#####	#####	81	1313	238	41	248	39	39
30	689	825	338	423	379	284	#####	#####	81	1321	237	41	247	39	39
35	541	735	346	426	388	279	#####	#####	81	1326	237	41	245	38	39
40	494	651	350	420	388	277	#####	#####	81	1331	235	42	243	37	39
45	469	593	348	408	384	274	#####	#####	80	1339	233	42	240	36	38
50	448	554	343	395	377	271	#####	#####	79	1346	233	43	239	35	38
55	438	527	337	382	369	268	#####	#####	78	1351	232	43	238	34	37
60	429	503	329	370	361	266	#####	#####	78	1355	232	44	237	34	37
65	406	482	323	361	352	266	#####	#####	78	1358	231	43	235	33	36
70	392	461	314	352	342	265	#####	#####	77	1360	231	44	235	33	36
75	377	441	307	345	333	264	#####	#####	76	1362	230	44	233	33	36
80	365	423	301	338	324	262	#####	#####	76	1364	228	44	232	34	35
85	351	407	294	329	316	260	#####	#####	75	1364	228	44	230	32	35

TEMPERATURE DATA SHEET #14A

		TEST TIME	85		
STACK AVG	587	TOP AVG	610	LT SIDE AVG	323
BACK AVG	378	RT SIDE AVG	357	BOTTOM AVG	279
FIREBOX AVG	########	SEC/CAT AVG	########	AMBIENT AVG	79

END	321.1	
START	371.4	
	-50.3	DELTA T

CIRCLE: LOSS / GAIN

ZERO / SPAN CHECK DATA SHEET #15-1

Date: 10-3-2008 Analyte: CO_2 (15-1)

Unit: Jotul F370 Run #: 3

Zero Cyl. #: 168TAC 3-A Conc.: 0.00 % CO_2 Cyl. Press.: 620 PSI

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

Span Cyl. #: 487905 Conc.: 12.20 % CO_2 Cyl. Press.: 1600 PSI

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

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

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

Flow: 1.5 SCFH Measured by: Rotameter

EPA Span Value = 25.0 % CO_2

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

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

PRE RUN Audit: by: [signature] Time: 1000 Temp: 69 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.001	-.053	-.053	-.211
SPAN	48.8	.488	12.20	48.6	.486	12.170	-.030	-.119

POST RUN Audit: by: [signature] Time: 1245 Temp: 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.028	-.028	-.110
SPAN	48.8	.488	12.20	49.0	.490	12.271	.071	.282

± 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: 10-3-2008 Analyte: O_2 (15-2)

Unit: Total F370 Run #: 3

Zero Cyl. #: 168TAC 3A Conc.: 0.00 % O_2 Cyl. Press.: 620 PSI

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

Span Cyl. #: 487905 Conc.: 12.60 % O_2 Cyl. Press.: 1600 PSI

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

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

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

Flow: 1.5 SCFH Measured by: Rotameter

EPA Span Value = 25.0 % O_2

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

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

PRE RUN Audit: by: [signature] Time: 1000 Temp: 69 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	-.0003	-.0003	-.003
SPAN	12.60	.504	12.6	12.6	.504	12.623	.023	.091

POST RUN Audit: by: [signature] Time: 1245 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	.002	.025	.025	.099
SPAN	12.60	.504	12.6	12.6	.505	12.648	.048	.191

± 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 : 10-3-2008 Analyte : CO (15-3)

Unit : Joful F370 Run # : 3

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO Cyl. Press. : 620 PSI

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

Span Cyl. # : C487905 Conc. : 14.90 % CO Cyl. Press. : 1600 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 10.0 % CO

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

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

PRE RUN Audit : by : [signature] Time : 1000 Temp : 69 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.00	.005	.005	.046
SPAN	49.0	.490	4.90	49.1	.491	4.912	.012	.124

POST RUN Audit : by : [signature] Time : 1245 Temp : 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.015	.015	.146
SPAN	49.0	.490	4.90	49.1	.491	4.912	.012	.124

± 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 : 10 - 3 - 2008 Analyte : SO_2 (15-4)

Unit : Jotul F370 Run # : 3

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 620 PSI

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

Span Cyl. # : CC82089 Conc. : 1250 ppm SO_2 Cyl. Press. : 1840 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO_2

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

PRE RUN Audit : by : [signature] Time : 1000 Temp : 69 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	9.087	9.087	.363
SPAN	50.0	.500	1250	49.7	.497	1242.9	-7.100	-.284

POST RUN Audit : by : [signature] Time : 1245 Temp : 78 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	4.102	4.102	.164
SPAN	50.0	.500	1250	50.0	.500	1250.4	.400	.016

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

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

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

QUALITY CHECKS DATA SHEET # 16

UNIT: Jotul F370 RUN: 3 DATE: 10-3-2008

Thermocouple Check:

T/C # 1	—	°F	T/C # 13	66.4	°F
T/C # 2	—	°F	T/C # 14	65.3	°F
T/C # 3	66.0	°F	T/C # 15	66.7	°F
T/C # 4	64.0	°F	T/C # 16	65.4	°F
T/C # 5	63.4	°F	T/C # 17	61.1	°F
T/C # 6	63.7	°F	T/C # 18	67.0	°F
T/C # 7	63.5	°F	T/C # 19	65.0	°F
T/C # 8	62.9	°F	T/C # 20	—	°F
T/C # 9	—	°F	T/C # 21	—	°F
T/C # 10	—	°F	T/C # 22	—	°F
T/C # 11	62.0	°F	T/C # 23	—	°F
T/C # 12	70.3	°F	T/C # 24	—	°F

Thermocouple Readout:

Pretest zero and span check and calibration			post test zero and span	% difference
ZERO -.4 °F	Adj. to 0.0 °F		ZERO 0.1 °F	Difference .005 %
SPAN 2000.8 °F	Adj. to 2000.0 °F		SPAN 2000.4 °F	Difference .020 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.0 °F	400	= 399.8 °F
600	= 594.7 °F	800	= 799.6 °F	1000	= 999.6 °F
1200	= 1199.5 °F	1400	= 1399.2 °F	1600	= 1599.2 °F
1800	= 1799.8 °F	2000	= 2000.0 °F		

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

Scale Check Pre: 380.0 — 370.0 = 10.0

Post: 379.4 — 369.4 = 10.0

Stack Cleaned Prior to Test Run: YES _____ NO X

1.29 / 2.15

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 4

MODEL: F370 DATE: 06-Oct-2008

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	300.500	0.150	77	0.30	3.80	450
5	302.000	0.160	77	0.33	7.40	425
10	303.608	0.150	77	0.29	4.30	450
15	305.127	0.190	77	0.20	5.20	400
20	306.835	0.190	77	0.19	5.80	400
25	308.543	0.130	77	0.23	7.40	475
30	309.982	0.210	77	0.22	7.50	375
35	311.805	0.240	78	0.30	8.40	350
40	313.764	0.240	78	0.29	9.70	350
45	315.723	0.240	79	0.15	8.60	350
50	317.689	0.240	80	0.10	8.30	350
55	319.663	0.210	81	0.19	8.70	375
60	321.512	0.210	81	0.23	7.40	375
65	323.362	0.210	82	0.06	5.90	375
70	325.218	0.210	82	0.08	5.10	375
75	327.074	0.210	83	0.13	5.00	375
80	328.937	0.180	83	0.20	4.90	400
85	330.684	0.180	83	0.28	4.80	400
90	332.430	0.180	83	0.23	4.70	400
95	334.177	0.180	83	0.29	4.50	400
100	335.924	0.180	83	0.36	4.40	400
105	337.671	0.160	83	0.42	4.20	425
110	339.315	0.160	83	0.53	4.00	425
115	340.959	0.160	83	0.55	3.90	425
120	342.603	0.160	84	0.57	3.60	425
125	344.254	0.160	84	0.60	3.40	425
130	345.904	0.180	84	0.56	3.50	400
135	347.657	0.180	84	0.57	3.10	400
140	349.410	0.180	84	0.56	2.80	400
145	351.163	0.180	84	0.45	3.10	400
150	352.917	0.180	84	0.31	3.00	400
155	354.670	0.180	84	0.33	3.00	400
160	356.423	0.180	84	0.39	4.10	400

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 4

MODEL: F370 DATE: 06-Oct-2008

****

METER CAL. FACTOR (Y) -------	0.94		Wt. WOOD BURNED(LB) -------	9.1	Lbs
BAROMETRIC PRESS.(Pb) -------	30.06	in Hg	WET,FUEL MOISTURE % -------	16.805	%
LEAK RATE POST (Lp) -------	0.015	cfm	Wt. PART. COLLECTED -------	0.1648	g
WATER VOL. (V1c) -------	66.5	Ml	METER VOLUME Vm -------	55.923	mcf
TEST TIME (MIN) -------	160	min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 4

MODEL: F370 DATE: 06-Oct-2008

****

AVG DELTA H	-------	0.19 in H2O		AVG PRCNT CO	-------	0.32	%
AVG METER TEMP. Tm	-------	81 deg F		AVG PRCNT CO2	-------	5.26	%
AVG PPM SO2	-------	399	PPM	AVG BAL CO2/CO	-------	16.54	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 4

MODEL: F370 DATE: 06-Oct-2008

****

STD SAMPLE VOL. Vm(std) d) ------	51.55 dscf	STACK GAS FLOW Qsd -------	672.836	dscf/Hr &	
			11.21	dscf/min	
VOL. WATER VAPOR Vw(s td) -----	3.130 scf	PARTICULATE CONCTRT. C s ------	0.0032	g/dscf	
PRCNT MSTR Bws -------	5.72 %	PARTC.EMISS. RATE E -------	2.15	g/Hr	
BURN RATE BR -------	1.29 Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.62	Lb-mole/Lb	
CO EMISSION RATE -------	71.62 g/Hr &	PART.EMISS. RATE ------	1.67	g/Kgdry fuel	
	55.61 g/Kgdry fuel				

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 4

MODEL: F370 DATE: 06-Oct-2008

	TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR		PROPRTN RATE VAR. AVERAGE
	5	627.1	98		100
	10	634.9	99		
	15	635.1	99		
	20	634.8	99		
	25	634.8	99		
	30	635.0	99		
	35	634.6	99		
	40	636.0	99		
	45	635.4	99		
	50	636.5	100		
	55	637.9	100		
	60	639.5	100		
	65	639.3	100		
	70	640.8	100		
	75	640.2	100		
	80	642.0	100		
	85	642.1	100		
	90	641.7	100		
	95	642.1	100		
	100	642.1	100		
	105	642.1	100		
	110	642.0	100		
	115	642.0	100		
	120	641.4	100		
	125	643.5	101		
	130	643.1	101		
	135	643.1	101		
	140	643.1	101		
	145	643.1	101		
	150	643.5	101		
	155	643.1	101		
	160	643.1	101		
	165				

7/16"

COMPUTER INPUT DATA SHEET #1

Client: Jotul North America

Address: 55 Hutcherson

Gorham, ME 04038

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

Run No.: 4 Date of Test: 10-6-2008 Burn Rate: 1.24

Model No.: F370 ☐ min ☐ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .940 (0.000) (Data Sheet #2) Post Leak Rate: .015 (.000) (Data Sheet #2) cfm Time: 160 (000) (Data Sheet #2) min.

Dry Gas Meter Volume: 55.923 (00.000) (Data Sheet #2) cf

Stack Flow: 8.721 (00.000) (Data Sheet #2) dscfm Δ H: .186 (.000) (Data Sheet #2) in. H_2O

Maximum Vac.: 3.0 (0.0) (Data Sheet #2) Barometric Pressure: 30.06 (00.00) (Data Sheet #2) in. Hg

H_2O Captured: 66.5 (00.0) (Data Sheet #3) g

Front Half Catch % Of Total: 40.2 (00.0) (Data Sheet #6) % Total Particulate Catch: .1648 (0.0000) (Data Sheet #6) g

Flue Gas Moisture: 5.7248 (00.000) (Data Sheet #7) %

Particulate Emission: .0493 (0.0000) (Data Sheet #7) gr/dscf

Relative Humidity: 57 (00.0) (Data Sheet #8) % RH Ambient Moisture: 1.75 (0.00) (Data Sheet #8) % H_2O

Preburn Fuel Wt.: 22.4 (00.0) (Data Sheet #8) lbs. Coal Bed Wt.: 1.9 (00.0) (Data sheet #8) lbs. Test Fuel Wt.: 9.1 (00.0) (Data sheet #8) lbs.

Heat Output (EPA Default): 15531.0 (00,000.0) (Data Sheet #8) BTU/hr

Kindling Fuel % Moisture (wet): 13.270 (00.000) (Data Sheet #10) % Pretest Fuel % Moisture (wet): 17.150 (00.000) (Data Sheet #10) %

Test Fuel % Moisture (dry): 20.200 (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) % Test Fuel % Moisture (wet): 16.805 %

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

Stack Static Pressure: -.050 (+/- .000) (Data Sheet #12) in. H_2O

Average Ambient Temperature: 74 (00) (Data Sheet #14) °F Stove Temperature Change: -37.6 (+/- 000.0) (Data Sheet #14) °F

Test start = 1210

Test End = 1450

meter Temp = 541

78 @ 15

METER BOX DATA SHEET PAGE # 2

Page: 1 of 2

UNIT: Jotul F370 RUN: 4 DATE: 10-6-2008

Meter Box: 5H Y Factor: .940

Leak checks: 15 " Hg @ .017 cfm _____ " Hg @ _____ cfm

15 " Hg @ .015 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .18			SAMPLING RATIO: 26 : 1				BP: 30.06		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1210	300.500	—	7.757	.15	77	450	77	2.0
5	15	302.000	—	8.213	.16	77	425	77	3.0
10	20	303.608	303.608	7.757	.15	77	450	77	2.0
15	25	305.127	305.127	8.727	.19	77	400	77	2.0
20	30	306.835	306.835	8.727	.19	77	400	77	2.0
25	35	308.543	308.543	7.349	.13	77	475	77	2.0
30	40	309.982	309.982	9.308	.21	77	375	77	2.0
35	45	311.805	311.805	9.955	.24	78	350	78	2.0
40	50	313.764	313.764	9.955	.24	78	350	78	2.0
45	55	315.723	315.723	9.936	.24	79	350	79	2.0
50	1300	317.689	317.689	9.918	.24	80	350	80	2.0
55	05	319.663	319.663	9.240	.21	81	375	81	2.0
ROTO PRESS: .18			TOTALS:	106.842	2.35	935	BP.: 30.06		
60	1310	321.512	321.512	9.240	.21	81	375	81	2.0
65	15	323.362	323.362	9.223	.21	82	375	82	2.0
70	20	325.218	325.218	9.223	.21	82	375	82	2.0
75	25	327.074	327.074	9.223	.21	83	375	83	2.0
80	30	328.937	328.937	8.630	.18	83	400	83	2.0
85	35	330.684	330.684	8.630	.18	83	400	83	2.0
90	40	332.430	332.430	8.630	.18	83	400	83	2.0
95	45	334.177	334.177	8.630	.18	83	400	83	2.0
100	50	335.924	335.924	8.630	.18	83	400	83	2.0
105	55	337.671	337.671	8.123	.16	83	425	83	2.0
110	1400	339.315	339.315	8.123	.16	83	425	83	2.0
115	05	340.959	340.959	8.123	.16	83	425	83	2.0
			TOTALS:	104.428	2.22	992	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	211.270	4.57	1927	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 2

UNIT: Jotul F370 RUN: 4 DATE: 10-6-08

Meter Box: 5H Y Factor: .940

Leak checks: 15 " Hg @ .017 cfm _____ " Hg @ _____ cfm

15 " Hg @ .015 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .18 SAMPLING RATIO: 26 : 1 BP: 30.06

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1410	342.603	342.603	8.108	.16	84	425	84	2.0
125	15	344.254	344.254	8.108	.16	84	425	84	2.0
130	20	345.904	345.904	8.614	.18	84	400	84	2.0
135	25	347.657	347.657	8.614	.18	84	400	84	2.0
140	30	349.410	349.410	8.614	.18	84	400	84	2.0
145	35	351.163	351.163	8.614	.18	84	400	84	2.0
150	40	352.917	352.917	8.614	.18	84	400	84	2.0
155	45	354.670	354.670	8.614	.18	84	400	84	2.0
* 160	50	356.423	356.423	8.614	.18	84	400	84	2.0
165				76.514	1.58	756			
170									
175									
ROTO PRESS:			TOTALS:				BP.:		
180									
185									
190									
195									
200									
205									
210									
215									
220									
225									
230						2683			
235									
			TOTALS:	287.784	6.15	81	MAX VACC =		3.0
TOTAL Cu Ft.		55.923	TOTALS:	8.721	.186	541	AVG. BP:	30.06	

* 33

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F370 RUN : 4 DATE : 10-6-08

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

SCALE	WEIGHT
295.0 g	295.0
590.0 g	590.0
885.0 g	885.0

IMPINGER	#1	#2	#3	#4
FINAL WT	659.2	592.0	485.5	864.6
INITIAL WT	609.4	587.6	484.0	853.8
NET WT GRAMS	49.8	4.4	1.5	10.8

TOTAL CATCH : 66.5 GRAMS H_2O

FRONT HALF

FILTER #	154F	
FINAL WT g	.7058	
INITIAL WT g	.6605	
NET WT g	.0453	

BEAKER #	111
DESC.	ACETONE
FINAL WT g	97.7630
INITIAL WT g	97.7415
NET WT g	.0215
VOL. DESC. ml	75

BACK HALF

FILTER #	154B	
FINAL WT g	.3777	
INITIAL WT g	.3609	
NET WT g	.0168	

BEAKER #	112	113	114	115	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	104.9438	106.4513	106.2017	106.8288	
INITIAL WT g	104.8859	106.4413	106.1920	106.8175	
NET WT g	.0579	.0100	.0097	.0113	.0210
VOL. DESC ml	110	75	125	150	275

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 9-5-2008 Time : 1100 By : CP

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : 413903

Back Size: 8.2 cm Lot No. :

	DATE: 9-8-2008	BY: AV	DATE: 9-9-2008	BY: AV	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
151F	0.6612	0939	0.6610	1002	✓	
152F	0.6600	0940	0.6600	1003	✓	
153F	0.6592	0941	0.6591	1004	✓	
154F	0.6606	0942	0.6605	1005	✓ ← F370	R-4
155F	0.6613	0943	0.6613	1006	✓	
156F	0.6603	0944	0.6601	1007	✓	
157F	0.6631	0945	0.6631	1008	✓	
158F	0.6642	0946	0.6641	1009	✓	
159F	0.6620	0947	0.6618	1010	✓	
160F	0.6593	0948	0.6594	1011	✓	
151B	0.3641	0949	0.3641	1012	✓	
152B	0.3603	0950	0.3603	1013	✓	
153B	0.3621	0951	0.3620	1014	✓	
154B	0.3608	0952	0.3609	1015	✓ ← F370	R-4
155B	0.3625	0953	0.3625	1016	✓	
156B	0.3648	0954	0.3648	1017	✓	
157B	0.3596	0955	0.3596	1018	✓	
158B	0.3640	0956	0.3639	1019	✓	
159B	0.3630	0957	0.3629	1020	✓	
160B	0.3644	0958	0.3643	1021	✓	

Checked by: C. Wadington Date: 9-10-08 Time: 1055

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
9-8-08	0930	CP	S	77	49
9-9-08	1000	CP		74	48

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 1-23-2008 Time : 1300 By : CP W

	DATE: 1-31-08	BY: CP	DATE: 2-1-08	BY: CP	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
101	95.5921	1905	95.5917	1536	✓	
102	96.3700	1906	96.3695	1537	✓	
103	102.3542	1907	102.3540	1538	✓	
104	106.2064	1908	106.2059	1539	✓	
105	107.0617	1909	107.0612	1540	✓	
106	96.7103	1910	96.7100	1541	✓	
107	107.3412	1911	107.3408	1542	✓	
108	104.9473	1912	104.9468	1543	✓	
109	98.8652	1913	98.8647	1544	✓	
110	104.0139	1914	104.0134	1545	✓	
111	97.7420	1915	97.7415	1546	✓	
112	104.8863	1916	104.8859	1547	✓	
113	106.4418	1917	106.4413	1548	✓ F370 R-4	
114	106.1925	1918	106.1920	1549	✓	
115	106.8180	1919	106.8175	1550	✓	
116	105.9332	1920	105.9329	1552	✓	
117	103.8876	1921	103.8872	1553	✓	
118	107.1528	1922	107.1523	1554	✓	
119	105.5019	1924	105.5014	1555	✓	
120	106.0900	1925	106.0898	1556	✓	
121	106.3660	1926	106.3656	1557	✓	
122	107.0219	1927	107.0214	1558	✓	
123	108.6517	1928	108.6512	1600	✓	
124	106.2091	1929	106.2087	1601	✓	
125	107.7520	1930	107.7515	1602	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH	
1-31-08	1900	CP		74	44	Checked by : CP W.
2-1-08	1530	CP		76	43	Date : 2-15-08
						Time : 1215

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F370 RUN : 4 DATE : 10-6-08 Page : 1 of 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
111	10-7	1200	Cp	97.7635	10-8	1014	Cp	97.7630	10-9	1039	Cp				
112	10-7	1200	Cp	104.9481	10-8	1015	Cp	104.9442	10-9	1041	Cp	104.9438	10-10	0937	Cp
113	10-7	1200	Cp	106.4518	10-8	1016	Cp	106.4513	10-9	1042	Cp				
114	10-7	1200	Cp	106.2025	10-8	1017	Cp	106.2013	10-9	1043	Cp	106.2017	10-10	0938	Cp
115	10-7	1200	Cp	106.8293	10-8	1019	Cp	106.8288	10-9	1044	Cp				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
154F	10-6	1630	Cp	.7055	10-7	1718	Cp	.7058	10-8	1021	Cp				
154B	10-6	1630	Cp	.3779	10-7	1719	Cp	.3777	10-8	1022	Cp				

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	10-7-08	1700	Cp	78	41
2	10-8-08	1000	Cp	78	49
3	10-9-08	1030	Cp	78	43
4	10-10-08	0930	Cp	78	40
5					

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 8-27-2008 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	1.0000	.0999	CP	8-27	0900	78	46
100.0001	10.0000	1.0000	.0999	CP	8-28	0930	78	46
100.0001	10.0001	1.0001	.0997	CP	8-29	1300	78	46
100.0000	10.0000	1.0000	.1000	CP	8-30	1030	78	46
100.0001	10.0003	1.0001	.0999	CP	8-31	1015	76	49
100.0000	10.0001	1.0000	.0997	CP	9-1	1100	74	44
100.0000	10.0001	.9999	.1000	CP	9-2	0845	75	48
99.9999	10.0000	.9999	.0998	CP	9-4	1000	77	47
99.9999	10.0002	1.0001	.0999	CP	9-8	0930	77	49
99.9999	9.9999	.9998	.0998	CP	9-9	1000	74	48
99.9997	9.9997	1.0000	.0999	CP	9-11	1500	76	45
100.0000	9.9997	.9999	.0999	CP	9-17	0930	77	49
100.0000	10.0000	1.0000	.0999	CP	9-18	0900	78	46
100.0000	10.0000	.9999	.0999	CP	9-19	0915	78	49
100.0000	10.0000	.9999	.0999	CP	9-22	1030	77	46
100.0000	10.0001	1.0000	.0998	CP	9-24	1330	78	49
100.0001	10.0001	1.0000	.0999	CP	9-25	0930	78	46
100.0000	9.9999	1.0001	.0998	CP	9-26	0920	78	46
100.0001	9.9999	1.0001	.0999	AV	9-29	0955	78	46
100.0000	10.0001	1.0000	.0998	CP	10-2	0945	75	44
100.0000	10.0000	1.0000	.0999	CP	10-3	0930	78	46
100.0000	9.9999	1.0000	.0999	CP	10-4	1530	78	46
100.0000	9.9999	.9999	.0999	CP	10-6	0930	77	49
100.0000	10.0001	1.0002	.1000	CP	10-7	1700	78	49
100.0000	10.0000	1.0000	.0999	CP	10-8	1000	78	49
99.9999	10.0000	1.0001	.0999	CP	10-9	1030	78	43
100.0000	9.9999	1.0001	.1000	CP	10-10	0930	78	40
100.0000	9.9998	.9999	.0997	CP	10-11	1430	74	47
100.0000	10.0001	1.0000	.1000	CP	10-13	0940	78	46
100.0000	10.0000	.9999	.0999	CP	10-14	2030	77	49
100.0000	10.0002	1.0000	.1000	CP	10-16	1220	78	43
100.0000	9.9999	1.0000	.0999	CP	10-18	1130	74	47

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-22-07 Through 8-26-2008	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0006	10.0001	1.0000	.0998	CP	10-22	1630	78	46
99.9999	10.0001	1.0000	.1001	CP	10-23	1000	74	44
100.0002	10.0002	1.0002	.0999	CP	10-24	1400	73	47
100.0002	10.0000	1.0001	.0998	CP	10-26	1700	74	40
100.0003	10.0001	1.0001	.0999	CP	10-27	0820	78	40
99.9999	10.0000	.9999	.0997	CP	10-28	1200	78	40
100.0000	9.9999	.9999	.0999	CP	10-29	1700	76	42
99.9998	9.9999	.9999	.1000	CP	10-30	1600	78	43
99.9997	10.0000	.9999	.0999	CP	11-16	1500	68	47
100.0001	10.0002	1.0000	.0999	CP	11-19	1730	73	40
100.0000	10.0002	.9999	.0999	CP	11-20	1100	69	44
2-08 99.9998	9.9999	.9999	.0998	CP	1-18-08	1230	76	45
100.0002	10.0002	.9999	.0999	CP	1-21-08	1430	65	48
99.9999	10.0002	1.0001	.0999	CP	1-22-08	1200	68	47
100.0002	9.9999	.9999	.0998	CP	1-23-08	1400	74	47
99.9999	10.0000	1.0002	.1000	CP	1-31-08	1900	74	44
100.0000	10.0003	1.0000	.0996	CP	2-1-08	1530	76	45
99.9997	9.9999	.9999	.0999	CP	2-16-08	1700	68	47
100.0001	10.0002	1.0000	.1000	CP	2-18-08	1400	72	46
99.9999	10.0001	.9999	.0998	CP	2-22-08	1800	68	47
99.9999	10.0001	1.0000	.0999	CP	2-23-08	1800	78	43
100.0000	10.0000	1.0000	.0999	CP	5-8-08	1030	78	43
100.0001	10.0001	1.0000	.0999	CP	5-9-08	0930	69	47
100.0000	10.0001	.9999	.0999	CP	5-10-08	1330	74	47
99.9998	9.9999	1.0000	.0998	CP	5-11-08	0900	74	44
100.0003	10.0001	.9999	.0998	CP	5-12	1400	70	48
99.9999	10.0001	1.0000	.1000	CP	5-13	1000	77	42
99.9999	9.9997	1.0000	.1000	CP	5-14	1230	77	42
99.9999	10.0001	.9999	.1000	CP	6-5-08	1430	72	46
100.0001	10.0000	1.0000	.0999	CP	6-9-08	1400	74	44
99.9999	9.9999	1.0000	.0999	CP	6-9-08	1800	73	47
100.0001	10.0001	.9999	.0998	CP	8-11-08	0930	77	42
100.0003	10.0000	1.0001	.0999	CP	8-12-08	1011	78	43
100.0000	10.0001	1.0000	.0999	CP	8-13-08	0950	76	49
100.0002	10.0000	1.0000	.0998	CP	8-18-08	0930	74	44
100.0001	9.9999	1.0000	.0998	CP	8-20-08	1110	76	45
100.0000	9.9999	.9999	.0998	CP	8-21-08	0915	75	48
100.0002	10.0000	1.0000	.1002	CP	8-22-08	0910	75	45
100.0000	10.0001	1.0001	.0999	CP	8-26-08	0900	78	43

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-26-2007 Through 10-14-2007	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9997	10.0001	1.0001	.0999	CP	4-26	0815	73	47
100.0002	10.0001	1.0000	.0999	CP	4-27	1400	78	46
99.9999	10.0000	1.0000	.1000	CP	4-29	1100	74	44
100.0003	10.0001	.9999	.1000	CP	5-1	1000	71	45
100.0003	10.0001	.9999	.1000	CP	5-2	1530	76	45
100.0001	9.9999	1.0000	.1000	CP	5-9	1400	78	46
100.0001	10.0000	1.0000	.0998	CP	5-13	1630	76	45
100.0002	10.0001	1.0000	.1000	CP	5-18	1350	77	46
100.0003	10.0001	1.0000	.0998	CP	5-21	1300	72	46
99.9999	10.0001	1.0000	.1000	CP	5-22	1600	78	46
99.9999	10.0001	1.0000	.0996	CP	6-5	1530	74	44
100.0000	10.0001	.9998	.0999	CP	6-7	1030	70	48
100.0000	10.0001	1.0000	.1000	CP	6-8	1000	68	47
99.9998	10.0004	1.0000	.1000	CP	6-9	1300	78	40
99.9997	10.0000	1.0000	.1000	CP	6-10	1530	78	49
100.0003	10.0002	1.0000	.0998	CP	6-11	0900	72	46
99.9998	10.0000	.9999	.0998	CP	6-12	2100	78	40
99.9998	9.9998	1.0000	.0998	CP	6-13	1600	74	47
99.9999	9.9999	1.0000	.0999	CP	6-14	1630	77	49
99.9999	10.0000	1.0000	.1000	CP	6-15	1430	75	48
100.0001	10.0002	1.0001	.1000	CP	6-19	1040	78	46
100.0000	10.0001	.9999	.0997	CP	6-20	1050	75	48
99.9996	9.9998	.9999	.0998	CP	8-29	1830	74	48
100.0002	10.0002	1.0001	.0999	CP	8-31	1000	78	46
99.9999	10.0002	1.0001	.1000	CP	9-1	1130	77	46
99.9999	10.0001	.9999	.0999	CP	9-4	1100	78	43
99.9997	9.9999	.9998	.0998	CP	9-5	1000	78	46
100.0000	10.0000	.9999	.0999	CP	9-6	1500	78	46
99.9997	10.0000	1.0000	.1000	CP	9-7	1745	78	43
100.0001	10.0000	1.0000	.0997	CP	9-8	1500	78	46
100.0002	10.0000	.9999	.1000	CP	10-5	0930	75	48
100.0003	10.0003	1.0000	.0999	CP	10-6	1400	78	46
100.0001	10.0000	1.0000	.0999	CP	10-8	1000	75	44
100.0002	10.0001	1.0000	.0999	CP	10-9	1130	78	46
100.0001	10.0002	.9999	.0997	CP	10-10	1500	74	44
99.9999	10.0000	1.0001	.0999	CP	10-11	1120	75	48
100.0000	9.9999	.9999	.0998	CP	10-12	1130	72	45
100.0003	9.9999	1.0000	.1000	CP	10-13	1030	78	46
99.9999	10.0000	1.0000	.1000	CP	10-14	1410	78	46

BLANK PROCESSING DATA SHEET # 5

UNIT : F370 RUN : 4 DATE : 10-608

BLANKS DONE : 10-30-2007

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT #023283	FISHER OPTIMA LOT #035941	DWNA Inc Sparklettes Distilled
FINAL WEIGHT	108.9009	106.3077	106.9680
TARE WEIGHT	108.8995	106.3063	106.9644
NET WEIGHT	.0014	.0014	.0036

TARE BEAKERS INTO DESC : TIME : 1700 DATE : 10-20-07

DATE : 10-22 BY : Cp DATE : 10-23 BY Cp DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8994	1700	108.8995	1027		
B	106.3060	1701	106.3063	1028		
C	106.9639	1702	106.9644	1029		

FINAL BEAKERS INTO DESC : TIME : 1040 DATE : 10-27-07

DATE : 10-29 BY : Cp DATE : 10-30 BY Cp DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9011	1721	108.9009	1619		
B	106.3074	1722	106.3077	1621		
C	106.9678	1723	106.9680	1622		

TARE QC

DATE	TIME	BY	WB	DB	%
10-22	1630	Cp	S	78	46
10-23	1000	Cp		74	44

FINAL QC

DATE	TIME	BY	WB	DB	%
10-29	1700	Cp	S	76	42
10-30	1600	Cp		78	43

2.15

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: F370 RUN: 4 DATE: 10-6-08

BLANK CALCULATIONS

Acetone :	.0014	g ÷	200	ml =	.000007	g/ml
Dicholoromethane :	.0014	g ÷	75	ml =	.000019	g/ml
Distilled Water :	.0036	g ÷	200	ml =	.000018	g/ml

FRONT HALF CATCH

FILTERS : .0453 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0453 g

BEAKERS : .0215 (Total Catch) g - 75 (ml Acetone) (.000007 g) (Blank Value / ml Acetone) = .0210 g

.0005

TOTAL FRONT HALF CATCH : .0663 g

BACK HALF CATCH

FILTERS : .0168 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0168 g

BEAKERS :

Acetone : .0579 (Total Catch) g - 110 (ml Acetone) (.000007 g) (Blank Value / ml Acetone) = .0571 g

.0008

Extract : .0100 (Total Catch) g - 75 (ml Dichloromethane) (.000019 g) (Blank Value / Dichloromethane) = .0086 g

(.0014)

Water : .0210 (Total Catch) g - 275 (ml Water) (.000018 g) (Blank Value / Water) = .0160 g

.0050

TOTAL BACK HALF CATCH : .0985 g

TOTAL CATCH : .1648 g

% FRONT HALF : 40.2 %

CALCULATIONS DATA SHEET # 7

UNIT : Jotul F370 RUN : 4 DATE : 10-6-2008

1) Vm (std) = $\dfrac{(55.923 \text{ Vm})(17.64)(.940 \text{ mcf})\left(30.06 \text{ " Hg} + \dfrac{.186 \text{" } H_2O}{13.6}\right)}{(541 \text{ TmA})}$ = $\dfrac{51.5473}{000.0000}$ dscf

2) Vw (std) = (.04707) (66.5 ml H_2O) = $\dfrac{3.1302}{00.0000}$ scf

3) Asw = $\dfrac{(3.1302 \text{ scf})}{(3.1302 \text{ scf} + 51.5473 \text{ dscf})}$ = $\dfrac{.0572}{.0000}$ Bws × 100 = $\dfrac{5.7248}{00.0000}$ % H_2O

4) Cs = $\dfrac{(.1648 \text{ g.})}{(51.5473 \text{ dscf})}$ (15.43) = $\dfrac{.0493}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.1648 \text{ g.})}{(51.5473 \text{ dscf})}$ ($\dfrac{8.721}{00.0000}$ dscfm) (60) = $\dfrac{1.6729}{00.0000}$ g / hr

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

TEST DATA SHEET # 8

UNIT : Jotul F370 RUN : 4 DATE : 10-6-2008

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

Wet Bulb / Dry Bulb

Pre : WB : 65 DB : 76 = 55 % RH 1.7 % H_2O

Post : WB : 67 DB : 77 = 59 % RH 1.8 % H_2O

Average : 57 % RH 1.75 % H_2O

Empty Stove Weight (lbs) : N/A w/ stack & oil seal : Wet : N/A Dry : 367.4

Kindling Weight (lbs) : Paper : .1 Wood : 2.0

Preburn Fuel Weight : 12.4 + 8.0 Total : 20.4

Kindling & Preburn Fuel Weight (wood only) (lbs) : **Total :** 22.4

Coal Bed Wt Range (lbs) : 2.2 - 1.9 **Scale :** 369.6 - 369.3

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

Lower : .20 × fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight :** 1.9

Maximum Coal Bed Removal (lbs) : ((2.2 (Upper) + 1.9 (Lower)) ÷ 2) .25 = .5 (round down to nearest tenth)

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

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" × 4"	8	3	ALL	100%
2" × 4"	12.5	3	2"x4"s	

Test Fuel Weight : 9.1 lbs

Estimated Dry Burn Rate :

$$\frac{9.1 - (9.1 \times .16805)}{2.2046} \times \frac{60}{\underset{\text{TIME}}{160}} = 1.288 \text{ kg / hr}$$

Estimated BTU's/hr : 19,140 × $\frac{63}{100}$ × $\frac{1.288}{\text{DBR}}$ = 15531.0 BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : Jotul F370 Run : 4 Date : 10-6-2008

FIRE STARTED: 0850

WARM UP AND PREBURN:

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

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

CHARCOAL BED PREPARATION :

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

TEST:

DOOR wide open during loading Ø min. 45 sec.

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

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

NO **FAN:**

~~ON / OFF during warm-up~~ ~~ON / OFF during preburn~~

~~ON / OFF first ____ minutes of test~~ ~~ON / OFF balance of test run~~

~~Fan speed set at ____~~

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 X inches.

1st warm up / pre-burn fuel charge (12.4 lbs.) added at 0915

2nd warm up / pre-burn fuel charge (8.0 lbs.) added at 1030

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

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

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

TEST DATA SHEET #10

Unit : Jotul F370 Run : 4 Date : 10-6-2008

Room Temperature : 70 °F Temperature Correction Set?: YES NO

Calibration Check : 12.0% + or- 0.2%? YES NO

Time Test Fuel moisture reading taken : 1045

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Average
1	2"×4"×8'	K	14.7	15.5	15.7	15.3
2						
3						
4	2"×4"×8'	P	22.7	21.0	21.9	21.9
5	2"×4"×8'	P	19.7	20.0	19.9	19.9
6	2"×4"×8'	P	20.8	19.4	20.6	20.3
7	2"×4"×8'	P				62.1
8	2"×4"×8'	P				
9						
10						
11	2x4x8"	T	18.1	18.4	18.5	18.3
12	"	T	18.2	18.2	18.4	18.3
13	"	T	20.1	20.9	20.9	20.6
14	2x4x12.5"	T	17.9	18.3	18.2	18.1
15	"	T	22.3	22.9	23.0	22.7
16	"	T	23.0	23.3	23.4	23.2
17						121.2
18						
19						
20	Spacers	T	21.3	22.0	21.4	21.567

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	15.300 %	20.700 %	20.200 %
Wet Moisture % :	13.270 %	17.150 %	16.805 %

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 with meter corrected for temperature.

GAS DATA SHEET #12

WEIGHT: 369.3 DATE: 10-6-2008

UNIT: Jotol F370 RUN: PAGE: 1 OF

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 1210	378.4	9.1	—	.155	3.8	.667	16.7	.029	.30	-.039	450
5 15	377.8	8.5	.6	.296	7.4	.520	13.0	.032	.33	-.050	425
10 20	377.3	8.0	.5	.174	4.3	.647	16.2	.028	.29	-.050	450
15 25	376.9	7.6	.4	.209	5.2	.615	15.4	.019	.20	-.054	400
20 30	376.3	7.0	.6	.236	5.8	.591	14.8	.018	.19	-.059	400
25 35	375.7	6.4	.6	.296	7.4	.524	13.1	.022	.23	-.060	475
30 40	374.9	5.6	.8	.301	7.5	.520	13.0	.021	.22	-.061	375
35 45	374.2	4.9	.7	.337	8.4	.484	12.1	.029	.30	-.065	350
40 50	373.4	4.1	.8	.389	9.7	.432	10.8	.028	.29	-.068	350
45 55	372.8	3.5	.6	.346	8.6	.480	12.0	.014	.15	-.065	350
50 1300	372.2	2.9	.6	.334	8.3	.496	12.4	.009	.10	-.064	350
53 05	371.7	2.4	.5	.350	8.7	.476	11.9	.018	.19	-.063	375
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.698	*****
60 10	371.3	2.0	.4	.298	7.4	.524	13.1	.022	.23	-.061	375
65 15	371.1	1.8	.2	.239	5.9	.591	14.8	.005	.06	-.056	375
70 20	370.9	1.6	.2	.207	5.1	.623	15.6	.007	.08	-.054	375
75 25	370.8	1.5	.1	.201	5.0	.623	15.6	.012	.13	-.051	375
80 30	370.7	1.4	.1	.200	4.9	.627	15.7	.019	.20	-.050	400
85 35	370.6	1.3	.1	.194	4.8	.627	15.7	.027	.28	-.049	400
90 40	370.5	1.2	.1	.190	4.7	.631	15.8	.022	.23	-.048	400
95 45	370.4	1.1	.1	.182	4.5	.639	16.0	.028	.29	-.047	400
100 50	370.3	1.0	.1	.177	4.4	.639	16.0	.035	.36	-.046	400
105 55	370.2	.9	.1	.171	4.2	.643	16.1	.041	.42	-.045	425
110 1400	370.1	.8	.1	.161	4.0	.647	16.2	.052	.53	-.044	425
115 05	370.0	.7	.1	.160	3.9	.651	16.3	.054	.55	-.043	425
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.594	*****
120 10	369.9	.6	.1	.146	3.6	.663	16.6	.056	.57	-.042	425
125 15	369.8	.5	.1	.140	3.4	.671	16.8	.059	.60	-.041	425
130 20	369.7	.4	.1	.143	3.5	.667	16.7	.055	.56	-.041	400
135 25	369.7	.4	.0	.127	3.1	.683	17.1	.056	.57	-.040	400
140 30	369.6	.3	.1	.114	2.8	.695	17.4	.055	.56	-.039	400
145 35	369.5	.2	.1	.125	3.1	.687	17.2	.044	.45	-.039	400
150 40	369.5	.2	.0	.123	3.0	.695	17.4	.030	.31	-.038	400
155 45	369.4	.1	.1	.121	3.0	.695	17.4	.032	.33	-.037	400
160 50	369.3	.0	.1	.166	4.1	.651	16.3	.038	.39	-.036	400
165 55											
170 1500											
175 05											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.353	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	16.45	*****

NO Fan?

-.53

-.050

FREEBURN DATA SHEET #10

UNIT: Jotul F370 RUN: 4 DATE: 10-6-2008 PAGE: 1 of

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 / 1110	370.4	—	524	609	306	364	348	266			74	-060	PREBURN START: # 8 UP
5 / 15	370.1	.3	416	565	312	364	349	268			75	-055	COAL BED SCALE RANGE:
10 / 20	369.9	.2	360	522	314	359	345	274			75	-050	369.6 → 369.3
15 / 25	369.8	.1	333	481	311	348	338	276			73	-048	PRIMARY AIR: 7/16"
20 / 30	369.7	.1	312	435	302	328	323	281			74	-047	SECONDARY AIR: N/A
25 / 35	369.6	.1	308	422	297	321	318	280			74	-045	FAN: NONE
30 / 40	369.6	.0	302	408	294	315	311	280			74	-045	PUMPS ON AT: ✓
35 / 45	369.5	.1	292	393	289	306	304	273			74	-044	CHECK WB/DB: N/A
40 / 50	369.5	.0	283	379	282	298	295	274			71	-043	
45 / 55	369.4	.1	281	366	274	290	285	271			70	-041	
50 / 1200	369.4	.0	296	361	272	285	282	274			71	-040	
55 / 05	369.3	.1	282	355	268	280	276	275			71	-040	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 / 10	369.3	.0	266	346	261	275	271	267			71	-039	
65													
70													
75													
80													

Jotul F370

Temperature Data Sheet 14

Run 4
10/06/2008

Time	Stack	Top	LT Side	Back	Rt Side	Bottom	Firebox	Sec/Cat	Ambient	Tube Furn	Smpl Box	Smpl Out	C-Gas Box	C-Gas Out	SO2 Out
********	Chn 103	Chn 104	Chn 105	Chn 106	Chn 107	Chn 108	Chn 109	Chn 110	Chn 111	Chn 112	Chn 113	Chn 114	Chn 115	Chn 116	Chn 117
0	266	346	261	275	271	275	######	######	71	1617	232	55	230	35	33
5	421	324	256	271	266	274	######	######	71	1614	231	43	231	34	33
10	348	341	248	265	258	271	######	######	70	1612	231	43	233	34	34
15	390	351	241	259	249	267	######	######	69	1610	231	43	235	34	34
20	428	404	233	254	240	261	######	######	69	1614	231	44	236	35	34
25	473	458	228	251	233	254	######	######	69	1624	231	43	238	35	35
30	491	500	224	253	230	245	######	######	70	1622	231	44	239	35	35
35	530	539	223	258	230	235	######	######	69	1619	232	44	241	35	35
40	585	593	225	267	235	226	######	######	70	1616	232	43	244	35	35
45	544	635	230	279	243	230	######	######	72	1613	234	43	246	35	36
50	518	629	236	289	250	224	######	######	73	1612	235	43	248	35	36
55	539	625	242	296	258	222	######	######	74	1612	236	43	248	35	36
60	495	619	250	303	267	217	######	######	74	1612	237	44	248	35	36
65	426	589	260	309	278	213	######	######	75	1612	237	44	248	35	37
70	379	552	270	314	288	210	######	######	75	1611	237	44	248	34	37
75	355	512	278	316	296	206	######	######	75	1609	238	44	247	34	37
80	342	484	282	315	303	206	######	######	75	1606	237	45	246	33	37
85	331	459	284	313	306	204	######	######	76	1602	238	45	245	33	36
90	322	439	283	310	307	204	######	######	76	1598	238	45	244	32	36
95	312	425	281	307	307	201	######	######	76	1594	238	46	243	32	36
100	301	407	277	302	305	203	######	######	75	1591	238	46	242	32	36
105	295	395	273	298	302	204	######	######	76	1589	239	47	242	32	35
110	290	384	268	292	299	204	######	######	76	1588	239	47	241	32	35
115	287	374	264	287	294	205	######	######	76	1587	239	47	241	31	35
120	279	366	260	283	290	204	######	######	75	1586	239	48	240	31	35
125	274	360	256	277	286	204	######	######	75	1584	238	48	239	31	35
130	274	354	251	273	281	206	######	######	75	1583	239	48	239	31	35
135	269	349	248	268	277	205	######	######	75	1582	239	48	239	31	35
140	262	341	244	263	272	205	######	######	75	1581	239	49	239	31	34
145	259	333	239	260	266	207	######	######	75	1580	239	47	238	31	34
150	253	326	235	255	260	206	######	######	75	1579	239	47	238	31	34
155	245	319	230	251	255	206	######	######	75	1578	239	48	238	31	34
160	241	312	227	247	249	205	######	######	74	1576	239	49	237	31	34

TEMPERATURE DATA SHEET #14A

		TEST TIME	160		
STACK AVG	364	TOP AVG	438	LT SIDE AVG	252
BACK AVG	281	RT SIDE AVG	271	BOTTOM AVG	221
FIREBOX AVG	########	SEC/CAT AVG	########	AMBIENT AVG	74

END	248.1	
START	285.7	
	-37.6	DELTA T

CIRCLE: LOSS / GAIN

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 10-6-2008 Analyte : CO_2 (15-1)

Unit : Jotul F370 Run # : 4

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO_2 Cyl. Press. : 600 PSI

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

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1560 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % CO_2

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

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

PRE RUN Audit : by : [signature] Time : 1030 Temp : 68 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.002	-.078	-.078	-.311
SPAN	48.8	.488	12.20	48.9	.489	12.246	.046	.182

POST RUN Audit : by : [signature] Time : 1515 Temp : 73 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	-.002	-.002	-.010
SPAN	48.8	.488	12.20	49.1	.491	12.296	.096	.383

± 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 : 10 - 6 - 2008 Analyte : O_2 (15-2)

Unit : Jotul F370 Run # : 4

Zero Cyl. # : 168TAC 3A Conc. : 0.00 % O_2 Cyl. Press. : 600 PSI

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

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1560 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % O_2

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

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

PRE RUN Audit : by : [signature] Time : 1030 Temp : 68 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.002	.025	.025	.099
SPAN	12.60	.504	12.6	12.6	.504	12.623	.023	.091

POST RUN Audit : by : [signature] Time : 1515 Temp : 73 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.003	.050	.050	.199
SPAN	12.60	.504	12.6	12.6	.503	12.598	-.002	-.009

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

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

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

ZERO / SPAN CHECK DATA SHEET #15-3

Date : 10-6-2008 Analyte : CO (15-3)

Unit : Jotul F370 Run # : 4

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO Cyl. Press. : 600 PSI

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

Span Cyl. # : C487905 Conc. : 4.90 % CO Cyl. Press. : 1560 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 10.0 % CO

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

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

PRE RUN Audit : by : [signature] Time : 1030 Temp : 68 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.001	.005	.005	.046
SPAN	49.0	.490	4.90	48.9	.489	4.892	-.008	-.075

POST RUN Audit : by : [signature] Time : 1515 Temp : 73 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.015	.015	.146
SPAN	49.0	.490	4.90	49.0	.490	4.902	.002	.025

± 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 : 10 - 6 - 2008 Analyte : SO_2 (15-4)

Unit : Jotul F370 Run # : 4

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 600 PSI

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

Span Cyl. # : CC82089 Conc. : 1250 ppm SO_2 Cyl. Press. : 1800 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO_2

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

PRE RUN Audit : by : [signature] Time : 1030 Temp : 68 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	9.087	9.087	.363
SPAN	50.0	.500	1250	50.1	.501	1252.9	2.900	.116

POST RUN Audit : by : [signature] Time : 1515 Temp : 73 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	4.102	4.102	.164
SPAN	50.0	.500	1250	50.3	.503	1257.9	7.900	.316

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

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

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

QUALITY CHECKS DATA SHEET # 16

UNIT : Jotul F370 RUN : 4 DATE : 10-6-2008

Thermocouple Check:

T/C # 1	— °F	T/C # 13	59.0 °F
T/C # 2	— °F	T/C # 14	58.6 °F
T/C # 3	58.9 °F	T/C # 15	59.1 °F
T/C # 4	55.9 °F	T/C # 16	67.1 °F
T/C # 5	55.2 °F	T/C # 17	65.4 °F
T/C # 6	55.3 °F	T/C # 18	61.6 °F
T/C # 7	55.4 °F	T/C # 19	57.4 °F
T/C # 8	54.7 °F	T/C # 20	— °F
T/C # 9	— °F	T/C # 21	— °F
T/C # 10	— °F	T/C # 22	— °F
T/C # 11	54.6 °F	T/C # 23	— °F
T/C # 12	62.6 °F	T/C # 24	— °F

Thermocouple Readout:

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

ZERO .5 °F Adj. to 0.0 °F ZERO 0.0 °F Difference Ø %

SPAN 1997.9 °F Adj. to 2000.0 °F SPAN 2001.6 °F Difference .080 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.2 °F	400	= 400.0 °F
600	= 599.8 °F	800	= 799.6 °F	1000	= 999.7 °F
1200	= 1199.7 °F	1400	= 1399.4 °F	1600	= 1599.4 °F
1800	= 1799.6 °F	2000	= 2000.0 °F		

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

Scale Check Pre : 379.4 — 369.4 = 10.0

Post : 379.3 — 369.3 = 10.0

Stack Cleaned Prior to Test Run : YES _____ NO X

1.05 / 3.84 g

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 1

MODEL: F370 DATE: 01-Oct-2008

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	143.000	0.150	82	0.28	2.30	350
5	144.500	0.170	82	0.36	6.00	325
10	146.154	0.100	83	0.47	2.60	425
15	147.424	0.100	83	0.44	3.10	425
20	148.694	0.100	83	0.67	2.90	425
25	149.964	0.110	83	0.12	5.50	400
30	151.313	0.110	84	0.20	6.20	400
35	152.667	0.100	84	0.20	6.20	425
40	153.942	0.100	84	0.11	6.90	425
45	155.216	0.090	84	0.18	7.90	450
50	156.420	0.100	86	0.26	8.90	425
55	157.704	0.090	86	0.30	10.10	450
60	158.917	0.090	86	0.33	9.90	450
65	160.133	0.080	87	0.23	8.90	475
70	161.289	0.080	89	0.22	6.50	475
75	162.454	0.080	89	0.29	4.80	450
80	163.683	0.090	89	0.32	4.40	425
85	164.985	0.090	89	0.40	4.20	425
90	166.287	0.090	89	0.49	4.10	425
95	167.588	0.090	89	0.61	3.90	425
100	168.890	0.090	89	0.67	3.80	425
105	170.192	0.110	89	0.68	3.80	400
110	171.575	0.110	89	0.75	3.70	400
115	172.958	0.110	89	0.76	3.60	400
120	174.341	0.110	89	0.78	3.40	400
125	175.724	0.090	89	0.81	3.40	425
130	177.027	0.110	89	0.69	3.60	400
135	178.411	0.110	89	0.68	3.50	400
140	179.795	0.110	89	0.45	3.70	400
145	181.178	0.110	89	0.45	3.80	400
150	182.562	0.110	89	0.49	3.70	400
155	183.946	0.110	89	0.49	3.70	400
160	185.330	0.110	89	0.50	3.70	400
165	186.714	0.110	89	0.53	3.50	400
170	188.098	0.110	89	0.44	3.20	400
175	189.481	0.110	89	0.50	3.00	400

180	190.865	0.110	89	0.55	2.90	400
185	192.249	0.110	89	0.57	2.80	400
190	193.633	0.110	89	0.50	2.60	400
195	195.017	0.110	89	0.51	2.40	400

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 1

MODEL: F370 DATE: 01-Oct-2008

****

METER CAL. FACTOR (Y)	-------	0.94	Wt. WOOD BURNED(LB)	-------	9.0 Lbs
BAROMETRIC PRESS.(Pb)	-------	29.93 in Hg	WET,FUEL MOISTURE %	-------	16.4 %
LEAK RATE POST (Lp)	-------	0.000 cfm	Wt. PART. COLLECTED	-------	0.3044 g
WATER VOL. (V1c)	-------	50.1 Ml	METER VOLUME Vm	-------	52.017 mcf
TEST TIME (MIN)	-------	195 min	HC MOLE FRACTION	-------	0.0132

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 1

MODEL: F370 DATE: 01-Oct-2008

****

AVG DELTA H	-------	0.10 in H2O		AVG PRCNT CO	-------	0.46	%
AVG METER TEMP. Tm	-------	87 deg F		AVG PRCNT CO2	-------	4.58	%
AVG PPM SO2	-------	413	PPM	AVG BAL CO2/CO	-------	10.02	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 1

MODEL: F370 DATE: 01-Oct-2008

****

STD SAMPLE VOL. Vm(std) d) ------	47.21 dscf	STACK GAS FLOW Qsd -------	595.202	dscf/Hr &
			9.92	dscf/min
VOL. WATER VAPOR Vw(s td) -----	2.358 scf	PARTICULATE CONCTRT. C s ------	0.0064	g/dscf
PRCNT MSTR Bws -------	4.76 %	PARTC.EMISS. RATE E -------	3.84	g/Hr
BURN RATE BR -------	1.05 Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.67	Lb-mole/Lb
CO EMISSION RATE -------	91.09 g/Hr &	PART.EMISS. RATE ------	3.66	g/Kgdry fuel
	86.75 g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 1

MODEL: F370 DATE: 01-Oct-2008

	TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR		PROPRTN RATE VAR. AVERAGE
	5	481.2	97		100
	10	492.2	99		
	15	493.7	99		
	20	493.7	99		
	25	493.7	99		
	30	493.1	99		
	35	494.5	99		
	40	494.8	99		
	45	494.4	99		
	50	493.8	99		
	55	496.4	100		
	60	496.5	100		
	65	497.3	100		
	70	497.7	100		
	75	500.6	100		
	80	500.3	100		
	85	500.6	100		
	90	500.6	100		
	95	500.2	100		
	100	500.6	100		
	105	500.6	100		
	110	500.5	100		
	115	500.5	100		
	120	500.5	100		
	125	500.5	100		
	130	501.0	101		
	135	500.9	101		
	140	500.9	101		
	145	500.5	100		
	150	500.9	101		
	155	500.9	101		
	160	500.9	101		
	165	500.9	101		
	170	500.9	101		
	175	500.5	100		
	180	500.9	101		

185	500.9	101
190	500.9	101
195	500.9	101

(3/32")

3,84

COMPUTER INPUT DATA SHEET #1

Client: Jotul North America

Address: 55 Hutcherson
Gorham, ME 04038

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

Run No.: 1 Date of Test: 10-1-2008 Burn Rate: 1.050

Model No.: F370 ☐ min ☒ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .940 (0.000) (Data Sheet #2) Post Leak Rate: 0.00 cfm (.000) (Data Sheet #2) Time: 195 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 52.017 cf (00.000) (Data Sheet #2)

Stack Flow: 8.296 dscfm (00.000) (Data Sheet #2) Δ H: .104 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 2.0 (0.0) (Data Sheet #2) Barometric Pressure: 29.93 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 50.1 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 31.8 % (00.0) (Data Sheet #6) Total Particulate Catch: .3044 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 4.7578 % (00.000) (Data Sheet #7)

Particulate Emission: .0995 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 55 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.9 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 28.8 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 2.2 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 9.0 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 12662.5 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 12.075 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 16.365 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 19.617 % Test Fuel % Moisture (wet): 16.400 %
(00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove])

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

Stack Static Pressure: -.045 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 80 °F (00) (Data Sheet #14) Stove Temperature Change: -25.8 °F (+/- 000.0) (Data Sheet #14)

Test start = 1300

Test End = 1615

meter Temp = 547

METER BOX DATA SHEET PAGE # 2

Page: 1 of

UNIT: Jotul F370 RUN: 1 DATE: 10-1-2008

Meter Box: 5H Y Factor: .940

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

4 @ 15 15 " Hg @ .000 cfm " Hg @ cfm

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

ROTO: PRESS: .20			SAMPLING RATIO: 33 : 1				BP: 30.00		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1300	143.000	—	9.862	.15	82	350	82	2.0
5	05	144.500	—	10.621	.17	82	325	82	2.0
10	10	146.154	146.154	8.107	.10	83	425	83	2.0
15	15	147.424	147.424	8.107	.10	83	425	83	2.0
20	20	148.694	148.694	8.107	.10	83	425	83	2.0
25	25	149.964	149.964	8.613	.11	83	400	83	2.0
30	30	151.313	151.313	8.598	.11	84	400	84	2.0
35	35	152.667	152.667	8.092	.10	84	425	84	2.0
40	40	153.942	153.942	8.092	.10	84	425	84	2.0
45	45	155.216	155.216	7.642	.09	84	450	84	2.0
50	50	156.420	156.420	8.062	.10	86	425	86	2.0
55	55	157.704	157.704	7.614	.09	86	450	86	2.0
ROTO PRESS: .20			TOTALS:	101.517	1.32	1004	BP.: 29.92		
60	1400	158.917	158.917	7.594	.09	86	450	86	2.0
65	05	160.133	160.133	7.181	.08	87	475	87	2.0
70	10	161.289	161.289	7.155	.08	89	475	89	2.0
75	15	162.454	162.454	7.552	.08	89	450	89	2.0
80	20	163.683	163.683	7.997	.09	89	425	89	2.0
85	25	164.985	164.985	7.997	.09	89	425	89	2.0
90	30	166.287	166.287	7.997	.09	89	425	89	2.0
95	35	167.588	167.588	7.997	.09	89	425	89	2.0
100	40	168.890	168.890	7.997	.09	89	425	89	2.0
105	45	170.192	170.192	8.497	.11	89	400	89	2.0
110	50	171.575	171.575	8.497	.11	89	400	89	2.0
115	55	172.958	172.958	8.497	.11	89	400	89	2.0
			TOTALS:	94.958	1.11	1063	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	196.475	2.43	2067	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 2

UNIT: Jotul F370 RUN: 1 DATE: 10-1-08

Meter Box: SH Y Factor: .940

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

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

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

ROTO: PRESS: .20			SAMPLING RATIO: 33			: 1	BP: 29.90		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1500	174.341	174.341	8.491	.11	89	400	89	2.0
125	05	175.724	175.724	7.991	.09	89	425	89	2.0
130	10	177.027	177.027	8.491	.11	89	400	89	2.0
135	15	178.411	178.411	8.491	.11	89	400	89	2.0
140	20	179.795	179.795	8.491	.11	89	400	89	2.0
145	25	181.178	181.178	8.491	.11	89	400	89	2.0
150	30	182.562	182.562	8.491	.11	89	400	89	2.0
155	35	183.946	183.946	8.491	.11	89	400	89	2.0
160	40	185.330	185.330	8.491	.11	89	400	89	2.0
165	45	186.714	186.714	8.491	.11	89	400	89	2.0
170	50	188.098	188.098	8.491	.11	89	400	89	2.0
175	55	189.481	189.481	8.491	.11	89	400	89	2.0
ROTO PRESS: .20			TOTALS:	101.392	1.30	1068	BP.: 29.90		
180	1600	190.865	190.865	8.491	.11	89	400	89	2.0
185	05	192.249	192.249	8.491	.11	89	400	89	2.0
190	10	193.633	193.633	8.491	.11	89	400	89	2.0
195	15	195.017	195.017	8.491	.11	89	400	89	2.0
200	20			33.964	.44	356			
205	25			135.356	1.74	1424			
210									
215									
220									
225									
230									
235									
			TOTALS:	331.831	4.17	3491	MAX VACC =		2.0
TOTAL Cu Ft.		52.017	TOTALS:	8.296	.104	87	AVG. BP:	29.93	

≤ 40

547

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F370 RUN : 1 DATE : 10-1-09

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	642.6	575.9	485.3	916.7
INITIAL WT	600.4	573.4	483.6	913.0
NET WT GRAMS	42.2	2.5	1.7	3.7

TOTAL CATCH : 50.1 GRAMS H_2O

FRONT HALF

FILTER #	151F	
FINAL WT g	.7280	
INITIAL WT g	.6610	
NET WT g	.0670	

BEAKER #	96
DESC.	ACETONE
FINAL WT g	104.0129
INITIAL WT g	103.9826
NET WT g	.0303
VOL. DESC. ml	80

BACK HALF

FILTER #	151B	
FINAL WT g	.4049	
INITIAL WT g	.3641	
NET WT g	.0408	

BEAKER #	97	98	99	100	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	100.1049	105.0390	104.9564	106.7594	
INITIAL WT g	99.9844	105.0251	104.9352	106.7416	
NET WT g	.1205	.0139	.0212 +	.0178	(.0390)
VOL. DESC ml	100	75	125 +	120	(245)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 9-5-2008 Time : 1100 By : CP

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : 413903

Back Size: 8.2 cm Lot No. :

	DATE: 9-8-2008	BY: AV	DATE: 9-9-2008	BY: AV	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
151F	0.6612	09:39	0.6610	1002	✓ ← F370	R-1
152F	0.6600	0940	0.6600	1003	✓	
153F	0.6592	0941	0.6591	1004	✓	
154F	0.6606	0942	0.6605	1005	✓	
155F	0.6613	0943	0.6613	1006	✓	
156F	0.6603	0944	0.6601	1007	✓	
157F	0.6631	0945	0.6631	1008	✓	
158F	0.6642	0946	0.6641	1009	✓	
159F	0.6620	0947	0.6618	1010	✓	
160F	0.6593	0948	0.6594	1011	✓	
151B	0.3641	0949	0.3641	1012	✓ ← F370	R-1
152B	0.3603	0950	0.3603	1013	✓	
153B	0.3621	0951	0.3620	1014	✓	
154B	0.3608	0952	0.3609	1015	✓	
155B	0.3625	0953	0.3625	1016	✓	
156B	0.3648	0954	0.3648	1017	✓	
157B	0.3596	0955	0.3596	1018	✓	
158B	0.3640	0956	0.3639	1019	✓	
159B	0.3630	0957	0.3629	1020	✓	
160B	0.3644	0958	0.3643	1021	✓	

Checked by: C. Wadington Date: 9-10-08 Time: 1055

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
9-8-08	0930	CP		77	49
9-9-08	1000	CP		74	48

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 1-8-2008 Time : 1100 By : CP

	DATE: 1-18-2008	BY: CP	DATE: 1-21-2008	BY: CP	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
76	103.8038	1235	103.8033	1436	✓	
77	107.3866	1236	107.3864	1437	✓	
78	94.4938	1237	94.4943	1438	✓	
79	97.6167	1238	97.6163	1439	✓	
80	109.1248	1239	109.1245	1440	✓	
81	101.4636	1240	101.4635	1441	✓	
82	97.4749	1242	97.4749	1442	✓	
83	98.3276	1243	98.3275	1444	✓	
84	105.5525	1244	105.5527	1445	✓	
85	97.9922	1245	97.9918	1446	✓	
86	104.7432	1246	104.7433	1447	✓	
87	105.9182	1247	105.9183	1448	✓	
88	100.0030	1248	100.0028	1450	✓	
89	120.6720	1250	120.6720	1451	✓	
90	106.4039	1251	106.4042	1452	✓	
91	95.0504	1252	95.0502	1453	✓	
92	96.6794	1253	96.6794	1454	✓	
93	107.8846	1255	107.8848	1455	✓	
94	106.3689	1256	106.3687	1456	✓	
95	107.4094	1257	107.4092	1457	✓	
96	103.9824	1258	103.9826	1458	✓	
97	99.9846	1259	99.9844	1459	✓	
98	105.0256	1300	105.0251	1500	✓ R-1 F-370	
99	104.9354	1301	104.9352	1501	✓	
100	106.7417	1302	106.7416	1502	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH	
1-18-2008	1230	CP		76	45	Checked by : CP LW
1-21-2008	1430	CP		65	48	Date : 2-15-08
						Time : 1216

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F370 RUN : 1 DATE : 10-1-08 Page : 1 of

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
96	10-2	945	CP	104.0124	10-3	0950	CP	104.0129	10-4	1539	CP				
97	10-2	945	CP	100.1044	10-3	0951	CP	100.1049	10-4	1540	CP				
98	10-2	945	CP	105.0385	10-3	0952	CP	105.0390	10-4	1541	CP				
99	10-2	945	CP	104.9563	10-3	0953	CP	104.9564	10-4	1542	CP				
100	10-2	945	CP	106.7589	10-3	0954	CP	106.7594	10-4	1543	CP				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
151F	10-1	1730	CP	.7285	10-2	0950	CP	.7280	10-3	0941	CP				
151B	10-1	1730	CP	.4079	10-2	0951	CP	.4066	10-3	0940	CP	.4053	10-4	1535	CP
				.4049	10-6	0940	CP								

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	10-2-08	0945	CP	75	44
2	10-3-08	0930	CP	78	46
3	10-4-08	1530	CP	78	46
4	10-6-08	0930	CP	77	49
5					

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 8-27-2008 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	1.0000	.0999	CP	8-27	0900	78	46
100.0001	10.0000	1.0000	.0999	CP	8-28	0930	78	46
100.0001	10.0001	1.0001	.0997	CP	8-29	1300	78	46
100.0000	10.0000	1.0000	.1000	CP	8-30	1030	78	46
100.0001	10.0003	1.0001	.0999	CP	8-31	1015	76	49
100.0000	10.0001	1.0000	.0997	CP	9-1	1100	74	44
100.0000	10.0001	.9999	.1000	CP	9-2	0845	75	48
99.9999	10.0000	.9999	.0998	CP	9-4	1000	77	47
99.9999	10.0002	1.0001	.0999	CP	9-8	0930	77	49
99.9999	9.9999	.9998	.0998	CP	9-9	1000	74	48
99.9997	9.9997	1.0000	.0999	CP	9-11	1500	76	45
100.0000	9.9997	.9999	.0999	CP	9-17	0930	77	49
100.0000	10.0000	1.0000	.0999	CP	9-18	0900	78	46
100.0000	10.0000	.9999	.0999	CP	9-19	0915	78	49
100.0000	10.0000	.9999	.0999	CP	9-22	1030	77	46
100.0000	10.0001	1.0000	.0998	CP	9-24	1330	78	49
100.0001	10.0001	1.0000	.0999	CP	9-25	0930	78	46
100.0000	9.9999	1.0001	.0998	CP	9-26	0920	78	46
100.0001	9.9999	1.0001	.0999	AV	9-29	0955	78	46
100.0000	10.0001	1.0000	.0998	CP	10-2	0945	75	44
100.0000	10.0000	1.0000	.0999	CP	10-3	0930	78	46
100.0000	9.9999	1.0000	.0999	CP	10-4	1530	78	46
100.0000	9.9999	.9999	.0999	CP	10-6	0930	77	49
100.0000	10.0001	1.0002	.1000	CP	10-7	1700	78	49
100.0000	10.0000	1.0000	.0999	CP	10-8	1000	78	49
99.9999	10.0000	1.0001	.0999	CP	10-9	1030	78	43
100.0000	9.9999	1.0001	.1000	CP	10-10	0930	78	40
100.0000	9.9998	.9999	.0997	CP	10-11	1430	74	47
100.0000	10.0001	1.0000	.1000	CP	10-13	0940	78	46
100.0000	10.0000	.9999	.0999	CP	10-14	2030	77	49
100.0000	10.0002	1.0000	.1000	CP	10-16	1220	78	43
100.0000	9.9999	1.0000	.0999	CP	10-18	1120	74	47

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-22-07 Through 8-26-2008	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0006	10.0001	1.0000	.0998	CP	10-22	1630	78	46
99.9999	10.0001	1.0000	.1001	CP	10-23	1000	74	44
100.0002	10.0002	1.0002	.0999	CP	10-24	1400	73	47
100.0002	10.0000	1.0001	.0998	CP	10-26	1700	74	40
100.0003	10.0001	1.0001	.0999	CP	10-27	0820	78	40
99.9999	10.0000	.9999	.0997	CP	10-28	1200	78	40
100.0000	9.9999	.9999	.0999	CP	10-29	1700	76	42
99.9998	9.9999	.9999	.1000	CP	10-30	1600	78	43
99.9997	10.0000	.9999	.0999	CP	11-16	1500	68	47
100.0001	10.0002	1.0000	.0999	CP	11-19	1730	73	40
100.0000	10.0002	.9999	.0999	CP	11-20	1100	69	44
2-08 99.9998	9.9999	.9999	.0998	CP	1-18-08	1230	76	45
100.0002	10.0002	.9999	.0999	CP	1-21-08	1430	65	48
99.9999	10.0002	1.0001	.0999	CP	1-22-08	1200	68	47
100.0002	9.9999	.9999	.0998	CP	1-23-08	1400	74	47
99.9999	10.0000	1.0002	.1000	CP	1-31-08	1900	74	44
100.0000	10.0003	1.0000	.0996	CP	2-1-08	1530	76	45
99.9997	9.9999	.9999	.0999	CP	2-16-08	1700	68	47
100.0001	10.0002	1.0000	.1000	CP	2-18-08	1400	72	46
99.9999	10.0001	.9999	.0998	CP	2-22-08	1800	68	47
99.9999	10.0001	1.0000	.0999	CP	2-23-08	1800	78	43
100.0000	10.0000	1.0000	.0999	CP	5-8-08	1030	78	43
100.0001	10.0001	1.0000	.0999	CP	5-9-08	0930	69	47
100.0000	10.0001	.9999	.0999	CP	5-10-08	1330	74	47
99.9998	9.9999	1.0000	.0998	CP	5-11-08	0900	74	44
100.0003	10.0001	.9999	.0998	CP	5-12	1400	70	48
99.9999	10.0001	1.0000	.1000	CP	5-13	1000	77	42
99.9999	9.9997	1.0000	.1000	CP	5-14	1230	77	42
99.9999	10.0001	.9999	.1000	CP	6-5-08	1430	72	46
100.0001	10.0000	1.0000	.0999	CP	6-9-08	1400	74	44
99.9999	9.9999	1.0000	.0999	CP	6-9-08	1800	73	47
100.0001	10.0001	.9999	.0998	CP	8-11-08	0930	77	42
100.0003	10.0000	1.0001	.0999	CP	8-12-08	1011	78	43
100.0000	10.0001	1.0000	.0999	CP	8-13-08	0950	76	49
100.0002	10.0000	1.0000	.0998	CP	8-18-08	0930	74	44
100.0001	9.9999	1.0000	.0998	CP	8-20-08	1110	76	45
100.0000	9.9999	.9999	.0998	CP	8-21-08	0915	75	48
100.0002	10.0000	1.0000	.1002	CP	8-22-08	0910	75	45
100.0000	10.0001	1.0001	.0999	CP	8-26-08	0900	78	43

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-26-2007 Through 10-14-2007	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9997	10.0001	1.0001	.0999	CP	4-26	0815	73	47
100.0002	10.0001	1.0000	.0999	CP	4-27	1400	78	46
99.9999	10.0000	1.0000	.1000	CP	4-29	1100	74	44
100.0003	10.0001	.9999	.1000	CP	5-1	1000	71	45
100.0003	10.0001	.9999	.1000	CP	5-7	1530	76	45
100.0001	9.9999	1.0000	.1000	CP	5-9	1400	78	46
100.0001	10.0000	1.0000	.0998	CP	5-13	1630	76	45
100.0002	10.0001	1.0000	.1000	CP	5-18	1350	77	46
100.0003	10.0001	1.0000	.0998	CP	5-21	1300	72	46
99.9999	10.0001	1.0000	.1000	CP	5-22	1600	78	46
99.9999	10.0001	1.0000	.0996	CP	6-5	1530	74	44
100.0000	10.0001	.9998	.0999	CP	6-7	1030	70	48
100.0000	10.0001	1.0000	.1000	CP	6-8	1000	68	47
99.9998	10.0004	1.0000	.1000	CP	6-9	1300	78	40
99.9997	10.0000	1.0000	.1000	CP	6-10	1530	78	48
100.0003	10.0002	1.0000	.0998	CP	6-11	0900	72	46
99.9998	10.0000	.9999	.0998	CP	6-12	2100	78	40
99.9998	9.9998	1.0000	.0998	CP	6-13	1600	74	47
99.9999	9.9999	1.0000	.0999	CP	6-14	1630	77	49
99.9999	10.0000	1.0000	.1000	CP	6-15	1430	75	48
100.0001	10.0002	1.0001	.1000	CP	6-19	1040	78	46
100.0000	10.0001	.9999	.0997	CP	6-20	1050	75	48
99.9996	9.9998	.9999	.0998	CP	8-24	1830	74	48
100.0002	10.0002	1.0001	.0999	CP	8-31	1000	78	46
99.9999	10.0002	1.0001	.1000	CP	9-1	1130	77	46
99.9999	10.0001	.9999	.0999	CP	9-4	1100	78	43
99.9997	9.9999	.9998	.0998	CP	9-5	1000	78	46
100.0000	10.0000	.9999	.0999	CP	9-6	1500	78	46
99.9997	10.0000	1.0000	.1000	CP	9-7	1745	78	43
100.0001	10.0000	1.0000	.0997	CP	9-8	1500	78	46
100.0002	10.0000	.9999	.1000	CP	10-5	0930	75	48
100.0003	10.0003	1.0000	.0999	CP	10-6	1400	78	46
100.0001	10.0000	1.0000	.0999	CP	10-8	1000	75	44
100.0002	10.0001	1.0000	.0999	CP	10-9	1130	78	46
100.0001	10.0002	.9999	.0997	CP	10-10	1500	74	44
99.9999	10.0000	1.0001	.0999	CP	10-11	1120	75	48
100.0000	9.9999	.9999	.0998	CP	10-12	1130	72	45
100.0003	9.9999	1.0000	.1000	CP	10-13	1030	78	46
99.9999	10.0000	1.0000	.1000	CP	10-14	1410	78	46

BLANK PROCESSING DATA SHEET # 5

UNIT: F370 RUN: 1 DATE: 10-1-2006

BLANKS DONE: 10-30-2007

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT #023283	FISHER OPTIMA LOT #035941	DWNA Inc Sparklettes Distilled
FINAL WEIGHT	108.9009	106.3077	106.9680
TARE WEIGHT	108.8995	106.3063	106.9644
NET WEIGHT	.0014	.0014	.0036

TARE BEAKERS INTO DESC : TIME: 1700 DATE: 10-20-07

DATE: 10-22 BY: Cp DATE: 10-23 BY Cp DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8994	1700	108.8995	1027		
B	106.3060	1701	106.3063	1028		
C	106.9639	1702	106.9644	1029		

FINAL BEAKERS INTO DESC : TIME: 1040 DATE: 10-27-07

DATE: 10-29 BY: Cp DATE: 10-30 BY Cp DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9011	1721	108.9009	1619		
B	106.3074	1722	106.3077	1621		
C	106.9678	1723	106.9680	1622		

TARE QC

DATE	TIME	BY	WB	DB	%
10-22	1630	Cp		78	46
10-23	1000	Cp		74	44

FINAL QC

DATE	TIME	BY	WB	DB	%
10-29	1700	Cp		76	42
10-30	1600	Cp		78	43

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: F370 RUN: 1 DATE: 10-1-08

BLANK CALCULATIONS

Acetone :	.0014	g ÷	200	ml =	.000007	g/ml
Dicholoromethane :	.0014	g ÷	75	ml =	.000019	g/ml
Distilled Water :	.0036	g ÷	200	ml =	.000018	g/ml

FRONT HALF CATCH

FILTERS : .0670 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0670 g

BEAKERS : .0303 (Total Catch) g - 80 (ml Acetone) (.000007 g) (Blank Value / ml Acetone) = .0297 g

.0006

TOTAL FRONT HALF CATCH : .0967 g

BACK HALF CATCH

FILTERS : .0408 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0408 g

BEAKERS :

Acetone : .1205 (Total Catch) g - 100 (ml Acetone) (.000007 g) (Blank Value / ml Acetone) = .1198 g

.0007

Extract : .0139 (Total Catch) g - 75 (ml Dichloromethane) (.000019 g) (Blank Value / Dichloromethane) = .0125 g

(.0014)

Water : .0390 (Total Catch) g - 245 (ml Water) (.000018 g) (Blank Value / Water) = .0346 g

.0044

TOTAL BACK HALF CATCH : .2077 g

TOTAL CATCH : .3044 g

% FRONT HALF : 31.77 %

CALCULATIONS DATA SHEET # 7

UNIT : Jotul F370 RUN : 1 DATE : 10- 1 -2008

1) Vm (std) = $\dfrac{(52.017 \text{ Vm})(17.64)(.940 \text{ mcf})\left(29.93 \text{ " Hg} + \dfrac{.104 \text{ " } H_2O}{13.6}\right)}{(547 \text{ TmA})}$ = $\dfrac{47.2065}{000.0000}$ dscf

2) Vw (std) = (.04707) (50.1 ml H_2O) = $\dfrac{2.3582}{00.0000}$ scf

3) Asw = $\dfrac{(2.3582 \text{ scf})}{(2.3582 \text{ scf} + 47.2065 \text{ dscf})}$ = $\dfrac{.0476}{.0000}$ Bws × 100 = $\dfrac{4.7578}{00.0000}$ % H_2O

4) Cs = $\dfrac{(.3044 \text{ g.})}{(47.2065 \text{ dscf})}$ (15.43) = $\dfrac{.0995}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.3044 \text{ g.})}{(47.2065 \text{ dscf})}$ ($\dfrac{8.296}{00.0000}$ dscfm) (60) = $\dfrac{3.2097}{00.0000}$ g / hr

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

TEST DATA SHEET # 8

UNIT: Jotul F370 RUN: 1 DATE: 10-1-2008

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

Wet Bulb / Dry Bulb

Pre : WB: 67 DB: 78 = 55 % RH 1.8 % H_2O

Post : WB: 69 DB: 81 = 55 % RH 2.0 % H_2O

Average: 55 % RH 1.9 % H_2O

Empty Stove Weight (lbs): N/A w/ stack & oil seal : Wet: N/A Dry: 367.5

Kindling Weight (lbs): Paper: 1.1 Wood: 1.7

Preburn Fuel Weight: 15.0 + 12.1 + Total: 27.1

Kindling & Preburn Fuel Weight (wood only) (lbs): **Total:** 28.8

Coal Bed Wt Range (lbs): 2.2 - 1.8 **Scale:** 369.7 - 369.3

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

Lower : .20 × fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight:** 2.2

Maximum Coal Bed Removal (lbs): ((2.2 (Upper) + 1.8 (Lower)) ÷ 2) .25 = .5 (round down to nearest tenth)

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

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" × 4"	8	3	ALL	100%
2" × 4"	12.5	3	2"x4"s	

Test Fuel Weight: 9.0 lbs

Estimated Dry Burn Rate:

$$\frac{9.0 - (9.0 \times .16400)}{2.2046} \times \frac{60}{\underset{\text{TIME}}{195}} = 1.050 \text{ kg / hr}$$

Estimated BTU's/hr: $19{,}140 \times \frac{63}{100} \times \frac{1.050}{\text{DBR}} = 12{,}662.5$ BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : Jotul F370 Run : 1 Date : 10- 1 -2008

FIRE STARTED: 0817

WARM UP AND PREBURN:

PRIMARY AIR : Set wide open for all warm-up / preburn fuel charges. Then set to 3/32" at start of preburn.

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

CHARCOAL BED PREPARATION :

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

TEST:

DOOR wide open during loading Ø min. 40 sec.

PRIMARY AIR : Opened full for first _____ min., then set to run setting of 3/32".

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

NO **FAN:**

~~ON / OFF during warm-up~~ ~~ON / OFF during preburn~~

~~ON / OFF first _____ minutes of test~~ ~~ON / OFF balance of test run~~

~~Fan speed set at _____~~

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 X inches.

1st warm up / pre-burn fuel charge (15.0 lbs.) added at 0827

2nd warm up / pre-burn fuel charge (12.1 lbs.) added at 1007

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

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

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

TEST DATA SHEET #10

Unit : Jutul F370 Run : 1 Date : 10 / 1 -2008

Room Temperature : 73 °F Temperature Correction Set?: YES NO

Calibration Check : 12.0% + or- 0.2%? YES NO

Time Test Fuel moisture reading taken : 1100

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Average
1	2"×4"×8'	K	14.6	13.2	13.4	13.733
2						
3						
4	2"×4"×8'	P	20.1	20.5	22.5	21.0
5	2"×4"×8'	P	19.0	17.7	18.9	18.5
6	2"×4"×8'	P	18.8	19.3	19.4	19.2
7	2"×4"×8'	P				58.7
8	2"×4"×8'	P				
9						
10						
11	2x4x8"	T	18.1	18.2	18.4	18.2
12	"	T	18.3	18.4	18.4	18.4
13	"	T	22.7	22.5	22.5	22.6
14	2x4x12.5"	T	18.0	18.4	18.1	18.2
15	"	T	18.4	18.4	18.2	18.3
16	"	T	21.9	22.1	22.1	22.0
17						117.7
18						
19						
20	Spacers	T	21.6	21.7	21.3	21.5

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	13.733 %	19.567 %	19.617 %
Wet Moisture % :	12.075 %	16.365 %	16.400 %

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 with meter corrected for temperature.

GAS DATA SHEET #12

10-1-2008

WEIGHT: 369.7 DATE: 10-1-2008

UNIT: Jotol F370 RUN: 1 PAGE: 1 OF

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2 PPM
0 1300	378.7	9.0	—	.096	2.3	.722	18.2	.026	.28	.035	.350
5 05	378.2	8.5	.5	.242	6.0	.575	14.4	.034	.36	.044	.325
10 10	377.9	8.2	.3	.108	2.6	.707	17.7	.045	.47	.040	.425
15 15	377.5	7.8	.4	.126	3.1	.687	17.2	.042	.44	.041	.425
20 20	377.1	7.4	.4	.118	2.9	.687	17.2	.066	.67	.042	.425
NO Fan? 25 25	376.6	6.9	.5	.224	5.5	.603	15.1	.010	.12	.052	.400
30 30	376.0	6.3	.6	.251	6.2	.575	14.4	.018	.20	.058	.400
35 35	375.4	5.7	.6	.251	6.2	.575	14.4	.018	.20	.060	.425
40 40	374.9	5.2	.5	.278	6.9	.548	13.7	.009	.11	.061	.425
45 45	374.2	4.5	.7	.320	7.9	.508	12.7	.016	.18	.062	.450
50 50	373.7	4.0	.5	.357	8.9	.464	11.6	.024	.26	.064	.425
55 55	373.0	3.3	.7	.407	10.1	.416	10.4	.028	.30	.065	.450
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.624	*****
60 1400	372.3	2.6	.7	.397	9.9	.420	10.5	.031	.33	.066	.450
65 05	371.7	2.0	.6	.358	8.9	.464	11.6	.021	.23	.065	.475
70 10	371.5	1.8	.2	.262	6.5	.591	14.8	.020	.22	.058	.475
75 15	371.4	1.7	.1	.195	4.8	.627	15.7	.027	.29	.054	.450
80 20	371.3	1.6	.1	.177	4.4	.639	16.0	.030	.32	.050	.425
85 25	371.2	1.5	.1	.169	4.2	.647	16.2	.038	.40	.047	.425
90 30	371.1	1.4	.1	.165	4.1	.647	16.2	.047	.49	.045	.425
95 35	371.0	1.3	.1	.160	3.9	.647	16.2	.060	.61	.044	.425
100 40	370.9	1.2	.1	.155	3.8	.651	16.3	.066	.67	.043	.425
105 45	370.8	1.1	.1	.156	3.8	.651	16.3	.067	.68	.042	.400
110 50	370.8	1.1	.0	.151	3.7	.651	16.3	.074	.75	.042	.400
115 55	370.7	1.0	.1	.145	3.6	.655	16.4	.075	.76	.041	.400
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.597	*****
120 1500	370.6	.9	.1	.140	3.4	.663	16.6	.077	.78	.040	.400
125 05	370.6	.9	.0	.137	3.4	.659	16.5	.080	.81	.040	.425
130 10	370.5	.8	.1	.145	3.6	.659	16.5	.068	.69	.039	.400
135 15	370.4	.7	.1	.143	3.5	.663	16.6	.067	.68	.039	.400
140 20	370.4	.7	.0	.151	3.7	.663	16.6	.043	.45	.038	.400
145 25	370.3	.6	.1	.153	3.8	.659	16.5	.043	.45	.038	.400
150 30	370.2	.5	.1	.149	3.7	.663	16.6	.047	.49	.037	.400
155 35	370.1	.4	.1	.151	3.7	.663	16.6	.047	.49	.037	.400
160 40	370.1	.4	.0	.150	3.7	.663	16.6	.048	.50	.036	.400
165 45	370.0	.3	.1	.143	3.5	.667	16.7	.051	.53	.036	.400
170 50	369.9	.2	.1	.131	3.2	.683	17.1	.042	.44	.035	.400
175 55	369.9	.2	.0	.121	3.0	.691	17.3	.048	.50	.036	.400
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.451	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.672	*****

GAS DATA SHEET #12

WEIGHT: 369.7 DATE: 10-1-2008

UNIT: Total F 370 RUN: 1 PAGE: OF

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 1600	369.9	.2	.0	.119	2.9	.691	17.3	.053	.55	-.035	.400
185 05	369.8	.1	.1	.114	2.8	.695	17.4	.055	.57	-.035	.400
190 10	369.8	.1	Ø	.104	2.6	.702	17.6	.050	.52	-.035	400
195 15	369.7	Ø	.1	.097	2.4	.714	17.9	.051	.53	-.035	400
200 20											
205 25										.140	
210 30											
215 35											
220											
225											
230											
235											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
240											
245											
250											
255											
260											
265											
270											
275											
280											
285											
290											
295											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
300											
305											
310											
315											
320											
325											
330											
335											
340											
345											
350											
355											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-1.812	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.045	*****

÷40

FIREBOX DATA SHEET #15

UNIT: Jotul F370 RUN: 1 DATE: 10-1-2008 PAGE: 1 of

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 / 1200	370.2	—	441	436	309	347	330	246			78	.055	PREBURN START: # .5 UP
5 / 05	370.2	.0	381	423	304	341	326	247			78	.050	COAL BED SCALE RANGE:
10 / 10	370.1	.1	320	393	297	329	317	252			78	.047	369.7 → 369.3
15 / 15	370.1	0	314	386	294	325	313	254			78	.045	PRIMARY AIR: 3/32"
20 / 20	370.0	.1	306	371	287	316	305	256			78	.044	SECONDARY AIR: N/A
25 / 25	370.0	.0	298	359	280	307	297	256			78	.043	FAN: NONE
30 / 30	369.9	.1	294	351	273	297	289	251			78	.042	PUMPS ON AT: 1230
35 / 35	369.9	0	273	335	265	288	280	253			78	.038	CHECK WB/DB: N/A
40 / 40	369.8	.1	263	328	259	280	274	250			77	.037	
45 / 45	369.8	.0	254	319	253	273	266	247			77	.036	
50 / 50	369.8	.0	252	310	247	267	259	246			77	.036	
55 / 55	369.8	.0	244	302	242	261	253	244			77	.035	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 / 1300	369.7	.1	238	293	237	257	248	245			78	.035	
65													
70													
75													
80													

Jotul F370

Temperature Data Sheet 14

Run 1
10/1/2008

Time	Stack	Top	LT Side	Back	Rt Side	Bottom	Firebox	Sec/Cat	Ambient	Tube Furn	Smpl Box	Smpl Out	C-Gas Box	C-Gas Out	SO2 Out
********	Chn 103	Chn 104	Chn 105	Chn 106	Chn 107	Chn 108	Chn 109	Chn 110	Chn 111	Chn 112	Chn 113	Chn 114	Chn 115	Chn 116	Chn 117
0	238	293	237	257	248	245	#####	#####	78	1540	234	53	234	34	38
5	463	282	233	251	243	239	#####	#####	78	1534	233	41	233	34	38
10	257	301	226	246	239	236	#####	#####	77	1532	232	41	233	34	38
15	255	290	220	240	234	235	#####	#####	77	1532	232	41	232	34	38
20	248	287	213	234	230	232	#####	#####	77	1534	231	41	231	34	38
25	324	291	206	228	226	228	#####	#####	76	1537	231	41	231	35	39
30	391	340	201	225	223	221	#####	#####	77	1536	231	41	232	35	39
35	401	371	197	227	221	219	#####	#####	77	1535	231	41	233	35	39
40	418	402	197	231	222	214	#####	#####	78	1535	231	42	234	35	39
45	444	449	199	236	226	211	#####	#####	79	1537	232	42	234	35	39
50	491	506	203	245	233	207	#####	#####	80	1541	233	42	234	35	39
55	541	572	208	258	241	202	#####	#####	80	1564	234	43	234	36	39
60	531	602	214	272	252	197	#####	#####	81	1547	235	43	235	36	39
65	521	629	223	286	262	194	#####	#####	81	1526	237	43	234	36	38
70	409	596	234	297	272	193	#####	#####	82	1502	237	43	235	36	38
75	347	543	244	301	281	189	#####	#####	82	1479	238	44	236	36	38
80	313	497	254	301	285	188	#####	#####	81	1457	238	44	236	35	38
85	294	465	258	298	287	186	#####	#####	81	1438	237	44	235	35	37
90	283	434	261	295	287	187	#####	#####	82	1422	237	45	234	35	37
95	274	411	262	291	286	186	#####	#####	82	1408	237	45	233	35	37
100	263	393	261	287	284	187	#####	#####	81	1396	237	45	232	35	37
105	259	380	261	283	280	188	#####	#####	81	1386	236	45	231	35	37
110	254	363	258	278	278	187	#####	#####	81	1377	236	45	231	35	37
115	251	353	257	275	274	190	#####	#####	81	1369	236	45	230	35	37
120	242	342	253	271	271	189	#####	#####	81	1363	236	46	230	34	36
125	240	334	251	267	267	190	#####	#####	81	1357	235	46	229	34	36
130	237	328	249	264	263	191	#####	#####	81	1352	235	47	228	34	36
135	235	322	246	261	260	191	#####	#####	81	1347	235	47	231	34	36
140	230	317	244	259	256	192	#####	#####	80	1343	234	47	235	34	36
145	229	316	241	256	253	193	#####	#####	80	1340	234	47	239	34	36
150	227	312	239	253	251	192	#####	#####	80	1336	234	47	241	34	36
155	227	308	235	250	249	193	#####	#####	80	1334	234	47	243	34	36
160	226	305	233	248	248	194	#####	#####	80	1331	234	47	244	34	36
165	225	302	230	245	247	193	#####	#####	81	1329	234	48	245	34	36
170	222	300	229	243	245	195	#####	#####	81	1327	235	48	245	34	36

175	216	294	225	240	244	193	######	######	81	1326	234	48	246	33	36
180	215	294	224	238	240	194	######	######	81	1325	235	49	246	33	36
185	211	290	221	235	237	197	######	######	81	1324	235	50	246	33	36
190	208	287	218	232	234	192	######	######	81	1323	235	50	244	33	36
195	207	282	216	229	231	194	######	######	81	1321	235	49	241	33	36

TEMPERATURE DATA SHEET #14A

		TEST TIME	195		
STACK AVG	302	TOP AVG	375	LT SIDE AVG	232
BACK AVG	258	RT SIDE AVG	253	BOTTOM AVG	201
FIREBOX AVG	########	SEC/CAT AVG	########	AMBIENT AVG	80

END	230.3	
START	256.1	
	-25.8	DELTA T

CIRCLE: LOSS / GAIN

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 10- 1 -2008 Analyte : CO_2 (15-1)

Unit : Jotul F370 Run # : 1

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO_2 Cyl. Press. : 620 PSI

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

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1630 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % CO_2

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

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

PRE RUN Audit : by : [signature] Time : 1120 Temp : 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.028	-.028	-.110
SPAN	48.8	.488	12.20	48.8	.488	12.220	.020	.082

POST RUN Audit : by : [signature] Time : 1630 Temp : 80 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.028	-.028	-.110
SPAN	48.8	.488	12.20	48.5	.485	12.145	-.055	-.220

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

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

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

ZERO / SPAN CHECK DATA SHEET #15-2

Date : 10 - 1 - 2008 Analyte : O_2 (15-2)

Unit : Jotul F370 Run # : 1

Zero Cyl. # : 168TAC 3A Conc. : 0.00 % O_2 Cyl. Press. : 620 PSI

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

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1630 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % O_2

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

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

PRE RUN Audit : by : [signature] Time : 1120 Temp : 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.025	-.025	-.102
SPAN	12.60	.504	12.6	12.6	.504	12.623	.023	.091

POST RUN Audit : by : [signature] Time : 1630 Temp : 80 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.025	-.025	-.102
SPAN	12.60	.504	12.6	12.6	.503	12.598	-.002	-.009

± 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 : 10 - 1 - 2008 Analyte : CO (15-3)

Unit : Jotul F370 Run # : 1

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

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

Span Cyl. # : C487905 Conc. : 4.90 % CO Cyl. Press. : _____ PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 10.0 % CO

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

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

PRE RUN Audit : by : [signature] Time : 1120 Temp : 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.0015	.015	.146
SPAN	49.0	.490	4.90	49.0	.490	4.902	.002	.025

POST RUN Audit : by : [signature] Time : 1630 Temp : 80 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.001	.005	.005	.046
SPAN	49.0	.490	4.90	49.1	.491	4.912	.012	.124

± 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 : 10 - 1 - 2008 Analyte : SO_2 (15-4)

Unit : Jotul F370 Run # : 1

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

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

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

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO_2

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

PRE RUN Audit : by : [signature] Time : 1120 Temp : 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	4.102	4.102	.164
SPAN	50.0	.500	1250	50.0	.500	1250.4	.400	.016

POST RUN Audit : by : [signature] Time : 1630 Temp : 80 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.002	-.883	-.883	-.035
SPAN	50.0	.500	1250	50.1	.501	1252.9	2.900	.116

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

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

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

QUALITY CHECKS DATA SHEET # 16

UNIT : Jotul F370 RUN : 1 DATE : 10- 1 -2008

Thermocouple Check:

T/C # 1	—	°F	T/C # 13	66.0	°F
T/C # 2	—	°F	T/C # 14	65.7	°F
T/C # 3	65.4	°F	T/C # 15	66.1	°F
T/C # 4	64.3	°F	T/C # 16	71.6	°F
T/C # 5	63.5	°F	T/C # 17	69.9	°F
T/C # 6	63.8	°F	T/C # 18	65.5	°F
T/C # 7	63.6	°F	T/C # 19	64.8	°F
T/C # 8	63.6	°F	T/C # 20	—	°F
T/C # 9	—	°F	T/C # 21	—	°F
T/C # 10	—	°F	T/C # 22	—	°F
T/C # 11	62.4	°F	T/C # 23	—	°F
T/C # 12	66.7	°F	T/C # 24	—	°F

Thermocouple Readout:

Pretest zero and span check and calibration			post test zero and span		% difference
ZERO .1 °F	Adj. to 0.0 °F		ZERO 0.0 °F	Difference Ø %	
SPAN 1998.1 °F	Adj. to 2000.0 °F		SPAN 2001.5 °F	Difference .075 %	

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 199.9 °F	400	= 399.8 °F
600	= 599.6 °F	800	= 799.6 °F	1000	= 999.6 °F
1200	= 1199.6 °F	1400	= 1399.4 °F	1600	= 1599.4 °F
1800	= 1799.8 °F	2000	= 2000.0 °F		

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

Scale Check Pre : 380.0 — 370.0 = 10.0

Post : 379.7 — 369.7 = 10.0

Stack Cleaned Prior to Test Run : YES X NO _____

.91 / 2.86

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 2

MODEL: F370 DATE: 02-Oct-2008

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	196.000	0.150	70	0.56	3.10	425
5	197.500	0.230	73	0.33	3.10	325
10	199.497	0.150	74	0.25	1.70	425
15	201.031	0.120	74	0.35	2.30	475
20	202.403	0.120	75	0.34	1.80	475
25	203.780	0.130	75	0.61	1.80	450
30	205.234	0.150	76	0.47	3.10	425
35	206.779	0.190	77	0.15	5.30	375
40	208.536	0.190	77	0.22	7.30	375
45	210.293	0.190	78	0.23	7.20	375
50	212.057	0.190	79	0.19	7.30	375
55	213.827	0.220	79	0.10	7.60	350
60	215.724	0.190	80	0.24	8.40	375
65	217.500	0.190	80	0.16	8.90	375
70	219.277	0.190	81	0.22	9.20	375
75	221.061	0.190	81	0.13	8.00	375
80	222.844	0.190	82	0.24	7.90	375
85	224.634	0.150	82	0.22	4.90	425
90	226.214	0.160	82	0.13	4.60	400
95	227.892	0.150	82	0.19	4.50	425
100	229.472	0.150	83	0.24	4.40	425
105	231.057	0.150	83	0.30	4.40	425
110	232.643	0.150	83	0.33	4.30	425
115	234.229	0.150	83	0.32	4.30	425
120	235.814	0.140	83	0.47	4.20	425
125	237.401	0.140	83	0.54	4.20	425
130	238.989	0.140	83	0.63	4.00	425
135	240.576	0.140	83	0.68	3.90	425
140	242.163	0.140	83	0.72	3.80	425
145	243.750	0.140	83	0.77	3.50	425
150	245.338	0.140	83	0.77	3.50	425
155	246.925	0.140	83	0.81	3.50	425
160	248.512	0.130	83	0.78	3.50	450
165	250.011	0.130	83	0.84	3.40	450
170	251.510	0.130	83	0.85	3.40	450
175	253.009	0.130	83	0.48	4.00	450

180	254.509	0.130	83	0.43	4.00	450
185	256.008	0.130	83	0.45	3.80	450
190	257.505	0.130	83	0.50	3.90	450
195	259.006	0.130	83	0.56	3.90	450
200	260.505	0.130	83	0.58	3.70	450
205	262.004	0.130	83	0.57	3.40	450
210	263.503	0.130	83	0.56	2.90	450
215	265.003	0.130	83	0.57	2.80	450
220	266.502	0.130	83	0.45	2.40	450
225	268.001	0.130	83	0.47	2.20	450
230	269.500	0.120	83	0.46	2.00	475
235	270.920	0.120	83	0.47	1.80	475
240	272.341	0.120	83	0.44	1.50	475
245						

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 2

MODEL: F370 DATE: 02-Oct-2008

****

METER CAL. FACTOR (Y)	-------	0.94	Wt. WOOD BURNED(LB)	-------	9.6 Lbs
BAROMETRIC PRESS.(Pb)	-------	29.81 in Hg	WET,FUEL MOISTURE %	-------	16.166 %
LEAK RATE POST (Lp)	-------	0.000 cfm	Wt. PART. COLLECTED	-------	0.3646 g
WATER VOL. (V1c)	-------	74.7 Ml	METER VOLUME Vm	-------	76.341 mcf
TEST TIME (MIN)	-------	240 min	HC MOLE FRACTION	-------	0.0132

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 2

MODEL: F370 DATE: 02-Oct-2008

****

AVG DELTA H	-------	0.15 in H2O		AVG PRCNT CO	-------	0.44	%
AVG METER TEMP. Tm	-------	81 deg F		AVG PRCNT CO2	-------	4.26	%
AVG PPM SO2	-------	424	PPM	AVG BAL CO2/CO	-------	9.76	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 2

MODEL: F370 DATE: 02-Oct-2008

****

STD SAMPLE VOL. Vm(std) d) ------	69.83 dscf	STACK GAS FLOW Qsd -------	546.911	dscf/Hr &	
			9.12	dscf/min	
VOL. WATER VAPOR Vw(s td) -----	3.516 scf	PARTICULATE CONCTRT. C s ------	0.0052	g/dscf	
PRCNT MSTR Bws -------	4.79 %	PARTC.EMISS. RATE E -------	2.86	g/Hr	
BURN RATE BR -------	0.91 Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.71	Lb-mole/Lb	
CO EMISSION RATE -------	79.88 g/Hr &	PART.EMISS. RATE ------	3.13	g/Kgdry fuel	
	87.49 g/Kgdry fuel				

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 2

MODEL: F370 DATE: 02-Oct-2008

	TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR		PROPRTN RATE VAR. AVERAGE
	5	593.4	97		100
	10	602.0	98		
	15	604.0	99		
	20	603.2	99		
	25	604.8	99		
	30	604.5	99		
	35	605.5	99		
	40	607.1	99		
	45	606.5	99		
	50	607.8	99		
	55	609.3	100		
	60	609.0	100		
	65	610.3	100		
	70	610.0	100		
	75	611.9	100		
	80	611.0	100		
	85	612.8	100		
	90	613.0	100		
	95	612.7	100		
	100	612.4	100		
	105	613.8	100		
	110	614.2	100		
	115	614.2	100		
	120	613.8	100		
	125	614.5	100		
	130	614.9	101		
	135	614.5	100		
	140	614.5	100		
	145	614.5	100		
	150	614.9	101		
	155	614.5	100		
	160	614.5	100		
	165	614.6	100		
	170	614.6	100		
	175	614.6	100		
	180	615.0	101		

185	614.6	100
190	613.8	100
195	615.4	101
200	614.6	100
205	614.6	100
210	614.6	100
215	615.0	101
220	614.6	100
225	614.6	100
230	614.6	100
235	614.5	100
240	615.0	101

(1/8")

COMPUTER INPUT DATA SHEET #1

Client: Jotul North America

Address: 55 Hutcherson

Gorham, ME 04038

2,86

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

Run No.: 2 Date of Test: 10-2-2008 Burn Rate: .913

Model No.: F370 ☒ min ☐ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .940 (0.000) (Data Sheet #2) Post Leak Rate: .000 cfm (.000) (Data Sheet #2) Time: 240 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 76.341 cf (00.000) (Data Sheet #2)

Stack Flow: 8.161 dscfm (00.000) (Data Sheet #2) Δ H: .150 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 3.0 (0.0) (Data Sheet #2) Barometric Pressure: 29.81 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 74.7 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 22.8 % (00.0) (Data Sheet #6) Total Particulate Catch: .3646 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 4.7973 % (00.000) (Data Sheet #7)

Particulate Emission: .0806 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 57 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.75 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 24.5 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 2.1 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 9.6 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 11009.1 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 13.867 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 17.196 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 19.283 % Test Fuel % Moisture (wet): 16.166 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove])

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

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

Average Ambient Temperature: 25 °F (00) (Data Sheet #14) Stove Temperature Change: -46.0 °F (+/- 000.0) (Data Sheet #14)

Test start = 1150

Test End = 1550

meter Temp = 541

METER BOX DATA SHEET PAGE # 2

Page: 1 of 3

UNIT: Jotul F370 RUN: 2 DATE: 10-2-2008

Meter Box: 5H Y Factor: .940

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

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

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

ROTO: PRESS: .20 SAMPLING RATIO: 27.5 : 1 BP: 29.83

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1150	196.000	—	8.259	.15	70	425	70	2.0
5	55	197.500	—	10.739	.23	73	325	73	3.0
10	1200	199.497	199.497	8.197	.15	74	425	74	2.0
15	05	201.031	201.031	7.334	.12	74	475	74	2.0
20	10	202.403	202.403	7.320	.12	75	475	75	2.0
25	15	203.780	203.780	7.727	.13	75	450	75	2.0
30	20	205.234	205.234	8.166	.15	76	425	76	2.0
35	25	206.779	206.779	9.238	.19	77	375	77	2.0
40	30	208.536	208.536	9.238	.19	77	375	77	2.0
45	35	210.293	210.293	9.220	.19	78	375	78	2.0
50	40	212.057	212.057	9.203	.19	79	375	79	2.0
55	45	213.827	213.827	9.861	.22	79	350	79	2.0
ROTO PRESS:		.20	TOTALS:	104.502	2.03	907	BP.:	29.83	
60	1250	215.724	215.724	9.186	.19	80	375	80	2.0
65	55	217.500	217.500	9.186	.19	80	375	80	2.0
70	1300	219.277	219.277	9.169	.19	81	375	81	2.0
75	05	221.061	221.061	9.169	.19	81	375	81	2.0
80	10	222.844	222.844	9.169	.19	82	375	82	2.0
85	15	224.634	224.634	8.076	.15	82	425	82	2.0
90	20	226.214	226.214	8580	.16	82	400	82	2.0
95	25	227.892	227.892	8.076	.15	82	425	82	2.0
100	30	229.472	229.472	8.061	.15	83	425	83	2.0
105	35	231.057	231.057	8.061	.15	83	425	83	2.0
110	40	232.643	232.643	8.061	.15	83	425	83	2.0
115	45	234.229	234.229	8.061	.15	83	425	83	2.0
			TOTALS:	102.855	2.01	982	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	207.357	4.04	1889	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 3

UNIT: Jotul F370 RUN: 2 DATE: 10-2-2008

Meter Box: SH Y Factor: .940

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

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

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

ROTO: PRESS: .20			SAMPLING RATIO: 275			: 1	BP: 29.80		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1350	235.814	235.814	8.053	.14	83	425	83	2.0
125	55	237.401	237.401	8.053	.14	83	425	83	2.0
130	1400	238.989	238.989	8.053	.14	83	425	83	2.0
135	05	240.576	240.576	8.053	.14	83	425	83	2.0
140	10	242.163	242.163	8.053	.14	83	425	83	2.0
145	15	243.750	243.750	8.053	.14	83	425	83	2.0
150	20	245.338	245.338	8.053	.14	83	425	83	2.0
155	25	246.925	246.925	8.053	.14	83	425	83	2.0
160	30	248.512	248.512	7.605	.13	83	450	83	2.0
165	35	250.011	250.011	7.605	.13	83	450	83	2.0
170	40	251.510	251.510	7.605	.13	83	450	83	2.0
175	45	253.009	253.009	7.605	.13	83	450	83	2.0
ROTO PRESS: .20			TOTALS:	94.844	1.64	.996	BP.: 29.80		
180	1450	254.509	254.509	7.605	.13	83	450	83	2.0
185	55	256.008	256.008	7.605	.13	83	450	83	2.0
190	1500	257.507	257.507	7.605	.13	83	450	83	2.0
195	05	259.006	259.006	7.605	.13	83	450	83	2.0
200	10	260.505	260.505	7.605	.13	83	450	83	2.0
205	15	262.004	262.004	7.605	.13	83	450	83	2.0
210	20	263.503	263.503	7.605	.13	83	450	83	2.0
215	25	265.003	265.003	7.605	.13	83	450	83	2.0
220	30	266.502	266.502	7.605	.13	83	450	83	2.0
225	35	268.001	268.001	7.605	.13	83	450	83	2.0
230	40	269.500	269.500	7.205	.12	83	475	83	2.0
235	45	270.920	270.920	7.205	.12	83	475	83	2.0
			TOTALS:	90.400	1.54	996	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	185.304	3.18	1992	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 3 of 3

UNIT: Jotul F370 RUN: 2 DATE: 10-2-08

Meter Box: 5H Y Factor: .940

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

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

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

ROTO: PRESS: .20			SAMPLING RATIO: 27.5 : 1				BP: 29.80		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1550	272.341	272.341	7,205	.12	83	475	83	20
245									
250									
255									
260									
265									
270									
275									
280									
285									
290									
295									
ROTO PRESS:			TOTALS:				BP.:		
300									
305									
310									
315									
320									
325									
330									
335									
340									
345									
350						396.4			
355									
			TOTALS:	399.866	7.34	81	MAX VACC =		3.0
TOTAL Cu Ft.		76.341	TOTALS:	8.161	.150	541	AVG. BP: 29.81		

÷ 49

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F370 RUN : 2 DATE : 10-2-08

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	666.1	584.3	486.1	921.0
INITIAL WT	603.0	580.0	483.6	916.2
NET WT GRAMS	63.1	4.3	2.5	4.8

TOTAL CATCH : 74.7 GRAMS H_2O

FRONT HALF

FILTER #	152F	
FINAL WT g	.7271	
INITIAL WT g	.6600	
NET WT g	.0671	

BEAKER #	101
DESC.	ACETONE
FINAL WT g	95.6134
INITIAL WT g	95.5917
NET WT g	.0217
VOL. DESC. ml	60

BACK HALF

FILTER #	152B	
FINAL WT g	.4210	
INITIAL WT g	.3603	
NET WT g	.0607	

BEAKER #	102	103	104	105	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	96.5132	102.3867	106.2286	107.0897	
INITIAL WT g	96.3695	102.3540	106.2059	107.0612	
NET WT g	.1437	.0327	.0227	.0285	.0512
VOL. DESC ml	120	75	125	125	250

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 9-5-2008 Time : 1100 By : CD

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : 413903

Back Size: 8.2 cm Lot No. :

	DATE: 9-8-2008	BY: AV	DATE: 9-9-2008	BY: AV	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
151F	0.6612	0939	0.6610	1002	✓	
152F	0.6600	0940	0.6600	1003	✓ ← F370	R-2
153F	0.6592	0941	0.6591	1004	✓	
154F	0.6606	0942	0.6605	1005	✓	
155F	0.6613	0943	0.6613	1006	✓	
156F	0.6603	0944	0.6601	1007	✓	
157F	0.6631	0945	0.6631	1008	✓	
158F	0.6642	0946	0.6641	1009	✓	
159F	0.6620	0947	0.6618	1010	✓	
160F	0.6593	0948	0.6594	1011	✓	
151B	0.3641	0949	0.3641	1012	✓	
152B	0.3603	0950	0.3603	1013	✓ ← F370	R-2
153B	0.3621	0951	0.3620	1014	✓	
154B	0.3608	0952	0.3609	1015	✓	
155B	0.3625	0953	0.3625	1016	✓	
156B	0.3648	0954	0.3648	1017	✓	
157B	0.3596	0955	0.3596	1018	✓	
158B	0.3640	0956	0.3639	1019	✓	
159B	0.3630	0957	0.3629	1020	✓	
160B	0.3644	0958	0.3643	1021	✓	

Checked by: C. Wadington Date: 9-10-08 Time: 1055

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
9-8-08	0930	CD	S	77	49
9-9-08	1000	CD		74	46

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 1-23-2008 Time : 1300 By : CP LW

	DATE: 1-31-08	BY: CP	DATE: 2-1-08	BY: CP	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
101	95.5921	1905	95.5917	1536		
102	96.3700	1906	96.3695	1537		
103	102.3542	1907	102.3540	1538	F-370 R-2	
104	106.2064	1908	106.2059	1539		
105	107.0617	1909	107.0612	1540		
106	96.7103	1910	96.7100	1541		
107	107.3412	1911	107.3408	1542		
108	104.9473	1912	104.9468	1543		
109	98.8652	1913	98.8647	1544		
110	104.0139	1914	104.0134	1545		
111	97.7420	1915	97.7415	1546		
112	104.8863	1916	104.8859	1547		
113	106.4418	1917	106.4413	1548		
114	106.1925	1918	106.1920	1549		
115	106.8180	1919	106.8175	1550		
116	105.9332	1920	105.9329	1552		
117	103.8876	1921	103.8872	1553		
118	107.1528	1922	107.1523	1554		
119	105.5019	1924	105.5014	1555		
120	106.0900	1925	106.0898	1556		
121	106.3660	1926	106.3656	1557		
122	107.0219	1927	107.0214	1558		
123	108.6517	1928	108.6512	1600		
124	106.2091	1929	106.2087	1601		
125	107.7520	1930	107.7515	1602		

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
1-31-08	1900	CP		74	44
2-1-08	1530	CP		76	45

Checked by : CP LW

Date : 2-15-08

Time : 1215

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F370 RUN : 2 DATE : 10-2-08 Page : 1 of 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
101	10-3	1000	CP	95.6135	10-4	1550	CP	95.6134	10-6	0945	CP				
102	10-3	1000	CP	96.5137	10-4	1551	CP	96.5132	10-6	0946	CP				
103	10-3	1000	CP	102.3922	10-4	1552	CP	102.3896	10-6	0947	CP	102.3862	10-7	1712	CP
				102.3867	10-8	1004	CP								
104	10-3	1000	CP	106.2288	10-4	1553	CP	106.2286	10-6	0948	CP				
105	10-3	1000	CP	107.0900	10-4	1554	CP	107.0897	10-6	0949	CP				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
152F	10-2	1820	CP	.7315	10-3	0945	CP	.7294	10-4	1537	CP	.7276	10-6	0942	CP
				.7271	10-7	1710	CP								
152B	10-2	1820	CP	.4250	10-3	0946	CP	.4226	10-4	1536	CP	.4214	10-6	0943	CP
				.4210	10-7	1711	CP								

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	10-3-08	0930	CP	78	46
2	10-4-08	1530	CP	78	46
3	10-6-08	0930	CP	77	49
4	10-7-08	1700	CP	78	49
5	10-8-08	1000	CP	78	49

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 8-27-2008 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	1.0000	.0999	CP	8-27	0900	78	46
100.0001	10.0000	1.0000	.0999	CP	8-28	0930	78	46
100.0001	10.0001	1.0001	.0997	CP	8-29	1300	78	46
100.0000	10.0000	1.0000	.1000	CP	8-30	1030	78	46
100.0001	10.0003	1.0001	.0999	CP	8-31	1015	76	49
100.0000	10.0001	1.0000	.0997	CP	9-1	1100	74	44
100.0000	10.0001	.9999	.1000	CP	9-2	0845	75	48
99.9999	10.0000	.9999	.0998	CP	9-4	1000	77	47
99.9999	10.0002	1.0001	.0999	CP	9-8	0930	77	49
99.9999	9.9999	.9998	.0998	CP	9-9	1000	74	48
99.9997	9.9997	1.0000	.0999	CP	9-11	1500	76	45
100.0000	9.9997	.9999	.0999	CP	9-17	0930	77	49
100.0000	10.0000	1.0000	.0999	CP	9-18	0900	78	46
100.0000	10.0000	.9999	.0999	CP	9-19	0915	78	49
100.0000	10.0000	.9999	.0999	CP	9-22	1030	77	46
100.0000	10.0001	1.0000	.0998	CP	9-24	1330	78	49
100.0001	10.0001	1.0000	.0999	CP	9-25	0930	78	46
100.0000	9.9999	1.0001	.0998	CP	9-26	0920	78	46
100.0001	9.9999	1.0001	.0999	AV	9-29	0955	78	46
100.0000	10.0001	1.0000	.0998	CP	10-2	0945	75	44
100.0000	10.0000	1.0000	.0999	CP	10-3	0930	78	46
100.0000	9.9999	1.0000	.0999	CP	10-4	1530	78	46
100.0000	9.9999	.9999	.0999	CP	10-6	0930	77	49
100.0000	10.0001	1.0002	.1000	CP	10-7	1700	78	49
100.0000	10.0000	1.0000	.0999	CP	10-8	1000	78	49
99.9999	10.0000	1.0001	.0999	CP	10-9	1030	78	43
100.0000	9.9999	1.0001	.1000	CP	10-10	0930	78	40
100.0000	9.9998	.9999	.0997	CP	10-11	1430	74	47
100.0000	10.0001	1.0000	.1000	CP	10-13	0940	78	46
100.0000	10.0000	.9999	.0999	CP	10-14	2030	77	49
100.0000	10.0002	1.0000	.1000	CP	10-16	1220	78	43
100.0000	9.9999	1.0000	.0999	CP	10-18	1130	74	47

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-22-07 Through 8-26-2008	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0006	10.0001	1.0000	.0998	CP	10-22	1630	78	46
99.9999	10.0001	1.0000	.1001	CP	10-23	1000	74	44
100.0002	10.0002	1.0002	.0999	CP	10-24	1400	73	47
100.0002	10.0000	1.0001	.0998	CP	10-26	1700	74	40
100.0003	10.0001	1.0001	.0999	CP	10-27	0820	78	40
99.9999	10.0000	.9999	.0997	CP	10-28	1200	78	40
100.0000	9.9999	.9999	.0999	CP	10-29	1700	76	42
99.9998	9.9999	.9999	.1000	CP	10-30	1600	78	43
99.9997	10.0000	.9999	.0999	CP	11-16	1500	68	47
100.0001	10.0002	1.0000	.0999	CP	11-19	1730	73	40
100.0000	10.0002	.9999	.0999	CP	11-20	1100	64	44
2 08 99.9998	9.9999	.9999	.0998	CP	1-18-08	1230	76	45
100.0002	10.0002	.9999	.0999	CP	1-21-08	1430	65	48
99.9999	10.0002	1.0001	.0999	CP	1-22-08	1200	68	47
100.0002	9.9999	.9999	.0998	CP	1-23-08	1400	74	47
99.9999	10.0000	1.0002	.1000	CP	1-31-08	1900	74	44
100.0000	10.0003	1.0000	.0996	CP	2-1-08	1530	76	45
99.9997	9.9999	.9999	.0999	CP	2-16-08	1700	68	47
100.0001	10.0002	1.0000	.1000	CP	2-18-08	1400	72	46
99.9999	10.0001	.9999	.0998	CP	2-22-08	1800	68	47
99.9999	10.0001	1.0000	.0999	CP	2-23-08	1800	78	43
100.0000	10.0000	1.0000	.0999	CP	5-8-08	1030	78	43
100.0001	10.0001	1.0000	.0999	CP	5-9-08	0930	69	47
100.0000	10.0001	.9999	.0999	CP	5-10-08	1330	74	47
99.9998	9.9999	1.0000	.0998	CP	5-11-08	0900	74	44
100.0003	10.0001	.9999	.0998	CP	5-12	1400	70	48
99.9999	10.0001	1.0000	.1000	CP	5-13	1000	77	42
99.9999	9.9997	1.0000	.1000	CP	5-14	1230	77	42
99.9999	10.0001	.9999	.1000	CP	6-5-08	1430	72	46
100.0001	10.0000	1.0000	.0999	CP	6-9-08	1400	74	44
99.9999	9.9999	1.0000	.0999	CP	6-9-08	1800	73	47
100.0001	10.0001	.9999	.0998	CP	8-11-08	0930	77	42
100.0003	10.0000	1.0001	.0999	CP	8-12-08	1011	78	43
100.0000	10.0001	1.0000	.0999	CP	8-13-08	0950	76	49
100.0002	10.0000	1.0000	.0998	CP	8-18-08	0930	74	44
100.0001	9.9999	1.0000	.0998	CP	8-20-08	1110	76	45
100.0000	9.9999	.9999	.0998	CP	8-21-08	0915	75	48
100.0002	10.0000	1.0000	.1002	CP	8-22-08	0910	75	45
100.0000	10.0001	1.0001	.0999	CP	8-26-08	0900	78	43

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-26-2007 Through 10-14-2007	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9997	10.0001	1.0001	.0999	CP	4-26	0815	73	47
100.0002	10.0001	1.0000	.0999	CP	4-27	1400	78	46
99.9999	10.0000	1.0000	.1000	CP	4-29	1100	74	44
100.0003	10.0001	.9999	.1000	CP	5-1	1000	71	45
100.0003	10.0001	.9999	.1000	CP	5-7	1530	76	45
100.0001	9.9999	1.0000	.1000	CP	5-9	1400	78	46
100.0001	10.0000	1.0000	.0998	CP	5-13	1630	76	45
100.0002	10.0001	1.0000	.1000	CP	5-18	1350	77	46
100.0003	10.0001	1.0000	.0998	CP	5-21	1300	72	46
99.9999	10.0001	1.0000	.1000	CP	5-22	1400	78	46
99.9999	10.0001	1.0000	.0996	CP	6-5	1530	74	44
100.0000	10.0001	.9998	.0999	CP	6-7	1030	70	48
100.0000	10.0001	1.0000	.1000	CP	6-8	1000	68	47
99.9998	10.0004	1.0000	.1000	CP	6-9	1300	78	40
99.9997	10.0000	1.0000	.1000	CP	6-10	1530	78	48
100.0003	10.0002	1.0000	.0998	CP	6-11	0900	72	46
99.9998	10.0000	.9999	.0998	CP	6-12	2100	78	40
99.9998	9.9998	1.0000	.0998	CP	6-13	1600	74	47
99.9999	9.9999	1.0000	.0999	CP	6-14	1430	77	49
99.9999	10.0000	1.0000	.1000	CP	6-15	1430	75	48
100.0001	10.0007	1.0001	.1000	CP	6-19	1040	78	46
100.0000	10.0001	.9999	.0997	CP	6-20	1050	75	48
99.9996	9.9998	.9999	.0998	CP	8-24	1830	74	48
100.0002	10.0002	1.0001	.0999	CP	8-31	1000	78	46
99.9999	10.0002	1.0001	.1000	CP	9-1	1130	77	46
99.9999	10.0001	.9999	.0999	CP	9-4	1100	78	43
99.9997	9.9999	.9998	.0998	CP	9-5	1000	78	46
100.0000	10.0000	.9999	.0999	CP	9-6	1500	78	46
99.9997	10.0000	1.0000	.1000	CP	9-7	1745	78	43
100.0001	10.0000	1.0000	.0997	CP	9-8	1500	78	46
100.0002	10.0000	.9999	.1000	CP	10-5	0930	75	48
100.0003	10.0003	1.0000	.0999	CP	10-6	1400	78	46
100.0001	10.0000	1.0000	.0999	CP	10-8	1000	75	44
100.0002	10.0001	1.0000	.0999	CP	10-9	1130	78	46
100.0001	10.0002	.9999	.0997	CP	10-10	1500	74	44
99.9999	10.0000	1.0001	.0999	CP	10-11	1120	75	48
100.0000	9.9999	.9999	.0998	CP	10-12	1130	72	45
100.0003	9.9999	1.0000	.1000	CP	10-13	1030	78	46
99.9999	10.0000	1.0000	.1000	CP	10-14	1410	78	46

BLANK PROCESSING DATA SHEET # 5

UNIT : F370 RUN : 2 DATE : 10-2-08

BLANKS DONE : 10-30-2007

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT #023283	FISHER OPTIMA LOT #035941	DWNA Inc Sparklettes Distilled
FINAL WEIGHT	108.9009	106.3077	106.9680
TARE WEIGHT	108.8995	106.3063	106.9644
NET WEIGHT	.0014	.0014	.0036

TARE BEAKERS INTO DESC : TIME : 1700 DATE : 10-20-07

DATE : 10-22 BY : Cp DATE : 10-23 BY Cp DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8994	1700	108.8995	1027		
B	106.3060	1701	106.3063	1028		
C	106.9639	1702	106.9644	1029		

FINAL BEAKERS INTO DESC : TIME : 1040 DATE : 10-27-07

DATE : 10-29 BY : Cp DATE : 10-30 BY Cp DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9011	1721	108.9009	1619		
B	106.3074	1722	106.3077	1621		
C	106.9678	1723	106.9680	1622		

TARE QC

DATE	TIME	BY	WB	DB	%
10-22	1630	Cp		78	46
10-23	1000	Cp		74	44

FINAL QC

DATE	TIME	BY	WB	DB	%
10-29	1700	Cp		76	42
10-30	1600	Cp		78	43

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: F370 RUN: 2 DATE: 10-2-08

BLANK CALCULATIONS

Acetone :	.0014	g ÷	200	ml =	.000007	g/ml
Dicholoromethane :	.0014	g ÷	75	ml =	.000019	g/ml
Distilled Water :	.0036	g ÷	200	ml =	.000018	g/ml

FRONT HALF CATCH

FILTERS : .0617 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0617 g

BEAKERS : .0217 (Total Catch) g - 60 (ml Acetone) (.000007 g) (Blank Value / ml Acetone) = .0213 g

.0004

TOTAL FRONT HALF CATCH : .0830 g

BACK HALF CATCH

FILTERS : .0607 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0607 g

BEAKERS :

Acetone : .1437 (Total Catch) g - 120 (ml Acetone) (.000007 g) (Blank Value / ml Acetone) = .1429 g

.0008

Extract : .0327 (Total Catch) g - 75 (ml Dichloromethane) (.000019 g) (Blank Value / Dichloromethane) = .0313 g

(.0014)

Water : .0512 (Total Catch) g - 250 (ml Water) (.000018 g) (Blank Value / Water) = .0467 g

.0045

TOTAL BACK HALF CATCH : .2816 g

TOTAL CATCH : .3646 g

% FRONT HALF : 22.8 %

CALCULATIONS DATA SHEET # 7

UNIT : Jotul F370 RUN : 2 DATE : 10- 2 -2008

1) Vm (std) = $\dfrac{(76.341 \text{ Vm})(17.64)(.940 \text{ mcf})\left(29.81 \text{ "Hg} + \dfrac{.150 \text{" } H_2O}{13.6}\right)}{(541 \text{ TmA})}$ = 69.7766 / 000.0000 dscf

2) Vw (std) = (.04707) (74.7 ml H_2O) = 3.5161 / 00.0000 scf

3) Asw = $\dfrac{(3.5161 \text{ scf})}{(3.5161 \text{ scf} + 69.7766 \text{ dscf})}$ = .0480 / .0000 Bws × 100 = 4.7973 / 00.0000 % H_2O

4) Cs = $\dfrac{(.3646 \text{ g.})}{(69.7766 \text{ dscf})}$ (15.43) = .0806 / 0.0000 gr / dscf

5) Estimated g / hr = $\dfrac{(.3646 \text{ g.})}{(69.7766 \text{ dscf})}$ (8.161 / 00.0000 dscfm) (60) = 2.5586 / 00.0000 g / hr

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

TEST DATA SHEET # 8

UNIT: Jotul F370 RUN: 2 DATE: 10-2-2008

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

Wet Bulb / Dry Bulb

Pre : WB: 63 DB: 74 = 54 % RH 1.5 % H_2O

Post : WB: 68 DB: 78 = 60 % RH 2.0 % H_2O

Average: 57 % RH 1.75 % H_2O

Empty Stove Weight (lbs): N/A w/ stack & oil seal : Wet: N/A Dry: 367.5

Kindling Weight (lbs): Paper: .1 Wood: 1.8

Preburn Fuel Weight: 12.9 + 9.8 Total: 22.7

Kindling & Preburn Fuel Weight (wood only) (lbs): **Total:** 24.5

Coal Bed Wt Range (lbs): 2.4 - 2.0 **Scale:** 369.9 - 369.5

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

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

Maximum Coal Bed Removal (lbs): ((2.4 (Upper) + 2.0 (Lower)) ÷ 2) .25 = .5 (round down to nearest tenth)

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

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" x 4"	8	3	ALL	100%
2" x 4"	12.5	3	2"x4"s	

Test Fuel Weight: 9.6 lbs

Estimated Dry Burn Rate:

$$\frac{9.6 - (9.6 \times .16166)}{2.2046} \times \frac{60}{\underset{\text{TIME}}{240}} = .913 \text{ kg / hr}$$

Estimated BTU's/hr: 19,140 × $\frac{63}{100}$ × $\frac{.913}{\text{DBR}}$ = 11009.1 BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : Jotul F370 Run : 2 Date : 10-2-2008

FIRE STARTED: 0827

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 35 sec.

TEST:

DOOR wide open during loading Ø min. 45 sec.

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

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

NO **FAN:**

~~ON / OFF during warm-up~~ ~~ON / OFF during preburn~~

~~ON / OFF first _____ minutes of test~~ ~~ON / OFF balance of test run~~

~~Fan speed set at _____~~

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 X inches.

1st warm up / pre-burn fuel charge (12.9 lbs.) added at 0836

2nd warm up / pre-burn fuel charge (9.8 lbs.) added at 0941

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

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

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

TEST DATA SHEET #10

Unit : Jotul F370 Run : 2 Date : 10-2-2008

Room Temperature : 69 °F Temperature Correction Set?: YES NO

Calibration Check : 12.0% + or- 0.2%? YES NO

Time Test Fuel moisture reading taken : 1045

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Average
1	2"×4"×8'	K	16.9	15.5	15.9	16.100
2						
3						
4	2"×4"×8'	P	22.7	21.3	21.7	21.9
5	2"×4"×8'	P	19.4	19.7	19.5	19.5
6	2"×4"×8'	P	20.0	21.6	22.2	20.9
7	2"×4"×8'	P				62.3
8	2"×4"×8'	P				
9						
10						
11	2x4x8"	T	18.3	18.6	18.9	18.6
12	"	T	18.5	18.1	17.9	18.2
13	"	T	21.5	21.1	21.5	21.4
14	2x4x12.5"	T	21.0	20.7	21.1	20.9
15	"	T	18.0	18.4	18.3	18.2
16	"	T	19.0	18.1	18.1	18.4
17						115.7
18						
19						
20	Spacers	T	21.5	20.7	20.8	

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	16.100 %	20.767 %	19.283 %
Wet Moisture % :	13.867 %	17.196 %	16.166 %

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 with meter corrected for temperature.

GAS DATA SHEET #12

WEIGHT: 369.6 DATE: 8-2-2008

UNIT: Jotul F370 RUN: 2 PAGE: 1 OF

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0/50	379.2	9.6	—	.127	3.1	.683	17.1	.055	.56	.035	.425
5/55	378.9	9.3	.3	.125	3.1	.691	17.3	.032	.33	.035	.325
10/1200	378.7	9.1	.2	.072	1.7	.751	18.8	.024	.25	.033	.425
15/05	378.5	8.9	.2	.094	2.3	.723	18.1	.034	.35	.032	.475
20/10	378.2	8.6	.2	.073	1.8	.743	18.6	.033	.34	.033	.475
25/15	378.0	8.4	.2	.074	1.8	.735	18.4	.060	.61	.032	.450
30/20	377.6	8.0	.4	.127	3.1	.687	17.2	.046	.47	.040	.425
35/25	377.0	7.4	.6	.213	5.3	.611	15.3	.014	.15	.051	.375
40/30	376.4	6.8	.6	.294	7.3	.528	13.2	.021	.22	.055	.375
45/35	375.7	6.1	.7	.291	7.2	.532	13.3	.022	.23	.056	.375
50/40	375.1	5.5	.6	.294	7.3	.532	13.3	.018	.19	.058	.375
55/45	374.5	4.9	.6	.304	7.6	.524	13.1	.009	.10	.060	.350
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.520	*****
60/50	373.9	4.3	.6	.334	8.4	.484	12.1	.023	.24	.060	.375
65/55	373.3	3.7	.6	.358	8.9	.468	11.7	.015	.16	.062	.375
70/1300	372.6	3.0	.7	.369	9.2	.452	11.3	.021	.22	.063	.375
75/05	372.1	2.5	.5	.321	8.0	.504	12.6	.012	.13	.061	.375
80/10	371.7	2.1	.4	.317	7.9	.504	12.6	.023	.24	.060	.375
85/15	371.5	1.9	.2	.197	4.9	.623	15.6	.021	.22	.053	.425
90/20	371.4	1.8	.1	.187	4.6	.639	16.0	.012	.13	.050	.400
95/25	371.3	1.7	.1	.181	4.5	.643	16.1	.018	.19	.046	.425
100/30	371.3	1.7	.0	.179	4.4	.643	16.1	.023	.24	.044	.425
105/35	371.2	1.6	.1	.177	4.4	.643	16.1	.029	.30	.042	.425
110/40	371.1	1.5	.1	.175	4.3	.643	16.1	.032	.33	.041	.425
115/45	371.0	1.4	.1	.176	4.3	.643	16.1	.031	.32	.040	.425
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.622	*****
120/50	371.0	1.4	.0	.171	4.2	.643	16.1	.046	.47	.040	.425
125/55	370.9	1.3	.1	.171	4.2	.639	16.0	.053	.54	.039	.425
130/1400	370.8	1.2	.1	.164	4.0	.643	16.1	.062	.63	.038	.425
135/05	370.8	1.2	.0	.158	3.9	.647	16.2	.067	.68	.037	.425
140/10	370.7	1.1	.1	.156	3.8	.647	16.2	.071	.72	.036	.425
145/15	370.6	1.0	.1	.144	3.5	.659	16.5	.076	.77	.035	.425
150/20	370.6	1.0	.0	.141	3.5	.659	16.5	.076	.77	.034	.425
155/25	370.5	.9	.1	.142	3.5	.655	16.4	.080	.81	.033	.425
160/30	370.4	.8	.1	.141	3.5	.659	16.5	.077	.78	.032	.450
165/35	370.4	.8	.0	.140	3.4	.659	16.5	.083	.84	.032	.450
170/40	370.3	.7	.1	.138	3.4	.659	16.5	.084	.85	.033	.450
175/45	370.3	.7	.0	.162	4.0	.651	16.3	.047	.48	.032	.450
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.421	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.563	*****

NO Fan?

GAS DATA SHEET #12

WEIGHT: 369.6 DATE: 8-2-2008

UNIT: Jotol F 370 RUN: 2 PAGE: OF

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 50	370.2	.6	-1	.163	4.0	.651	16.3	.042	.43	.032	.450
185 55	370.1	.5	-1	.156	3.8	.659	16.5	.044	.45	.031	.450
190 1500	370.1	.5	.0	.158	3.9	.655	16.4	.049	.50	.031	.450
195 05	370.0	.4	-1	.157	3.9	.651	16.3	.055	.56	.030	.450
200 10	369.9	.3	-1	.150	3.7	.659	16.5	.057	.58	.030	.450
205 15	369.9	.3	.0	.137	3.4	.671	16.8	.056	.57	.029	.450
210 20	369.8	.2	-1	.120	2.9	.691	17.3	.055	.56	.029	.450
215 25	369.8	.2	-0	.113	2.8	.695	17.4	.056	.57	.028	.450
220 30	369.8	.2	-0	.098	2.4	.715	17.9	.044	.45	.027	.450
225 35	369.7	.1	-1	.091	2.2	.723	18.1	.046	.47	.026	.450
230 40	369.7	.1	-0	.083	2.0	.731	18.3	.045	.46	.025	.475
235 45	369.7	.1	-0	.074	1.8	.739	18.5	.046	.47	.025	.475
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.343	*****
240 50	369.6	.0	-1	.064	1.5	.751	18.8	.043	.44	.024	.475
245 55											
250 1600										.367	
255											
260											
265											
270											
275											
280											
285											
290											
295											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
300											
305											
310											
315											
320											
325											
330											
335											
340											
345											
350											
355											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.930	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.039	*****

÷ 49

PREBURN DATA SHEET #10

UNIT: Jotul F370 RUN: 2 DATE: 10-2-2008 PAGE: 1 of

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 / 1050	370.4	—	442	516	282	326	340	247			68	-.055	PREBURN START: # 5 UP
5 / 55	370.3	-.1	284	487	283	327	338	258			68	-.050	COAL BED SCALE RANGE:
10 / 1100	370.2	-.1	254	443	280	319	329	258			68	-.046	369.9 → 369.5
15 / 05	370.2	.0	247	421	275	310	320	263			68	-.044	PRIMARY AIR: 1/8"
20 / 10	370.1	-.1	240	400	269	301	308	265			67	-.043	SECONDARY AIR: N/A
25 / 15	370.1	.0	239	380	261	290	296	267			67	-.042	FAN: NONE
30 / 20	370.0	-.1	244	367	255	283	287	267			67	-.041	PUMPS ON AT:
35 / 25	370.0	-.0	252	351	251	274	276	267			66	-.039	CHECK WB/DB: N/A
40 / 30	369.9	-.1	256	339	246	269	269	267			67	-.038	
45 / 35	369.9	.0	239	326	242	261	261	265			67	-.037	
50 / 40	369.8	-.1	233	319	239	258	256	262			67	-.036	
55 / 45	369.7	-.1	227	307	235	252	250	262			67	-.035	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 / 50	369.6	-.1	212	300	235	249	247	257			67	-.035	
65 / 55													
70 / 1200													
75													
80													

Jotul F370

Temperature Data Sheet 14

Run 1
10/1/2008

Time	Stack	Top	LT Side	Back	Rt Side	Bottom	Firebox	Sec/Cat	Ambient	Tube Furn	Smpl Box	Smpl Out	C-Gas Box	C-Gas Out	SO2 Out
********	Chn 103	Chn 104	Chn 105	Chn 106	Chn 107	Chn 108	Chn 109	Chn 110	Chn 111	Chn 112	Chn 113	Chn 114	Chn 115	Chn 116	Chn 117
0	212	300	235	249	247	257	######	######	70	1345	235	47	231	35	34
5	265	284	231	244	242	257	######	######	70	1337	235	38	233	35	35
10	195	277	225	238	237	255	######	######	69	1330	235	38	235	35	35
15	193	270	218	231	231	253	######	######	70	1325	235	38	242	35	36
20	187	266	210	223	226	247	######	######	70	1318	235	39	244	35	36
25	195	257	202	217	220	243	######	######	70	1314	235	39	247	35	37
30	236	266	196	211	212	236	######	######	70	1311	235	40	241	35	37
35	365	325	190	207	207	232	######	######	70	1309	237	40	239	35	37
40	433	400	186	206	203	218	######	######	71	1308	240	40	238	35	38
45	438	451	184	211	202	217	######	######	71	1308	243	40	237	36	38
50	451	477	185	219	206	211	######	######	72	1310	245	41	236	36	39
55	469	497	188	228	211	206	######	######	72	1312	248	41	235	36	39
60	501	535	194	236	218	202	######	######	73	1313	244	41	237	36	39
65	529	568	198	246	227	197	######	######	74	1316	241	41	240	37	39
70	545	603	206	258	236	194	######	######	74	1319	240	42	242	37	39
75	498	623	212	271	246	191	######	######	75	1321	239	42	244	37	39
80	478	630	221	284	255	187	######	######	76	1323	238	43	246	37	39
85	370	583	231	292	267	184	######	######	76	1325	237	43	247	38	39
90	333	531	241	293	276	182	######	######	76	1327	237	43	248	37	39
95	312	488	249	292	281	181	######	######	77	1328	236	44	248	37	39
100	301	463	253	290	284	179	######	######	77	1329	260	44	248	37	38
105	291	436	255	286	285	179	######	######	77	1329	235	44	248	37	38
110	283	417	255	283	284	177	######	######	77	1329	235	45	248	37	38
115	278	402	254	279	283	177	######	######	77	1328	235	45	248	36	34
120	271	386	252	274	280	179	######	######	77	1328	235	45	248	36	34
125	265	376	248	270	277	177	######	######	77	1327	235	45	248	36	34
130	262	368	246	266	272	176	######	######	77	1326	234	45	248	36	34
135	259	356	244	262	268	179	######	######	77	1325	234	45	247	36	36
140	255	349	240	258	265	180	######	######	77	1325	234	45	246	35	36
145	248	342	236	254	260	180	######	######	77	1324	236	46	245	35	36
150	245	336	233	251	256	182	######	######	77	1323	237	46	243	35	36
155	242	324	230	247	252	183	######	######	77	1323	238	46	242	35	36
160	239	323	227	244	248	183	######	######	77	1322	239	46	242	34	35
165	240	318	225	242	245	184	######	######	77	1322	240	47	241	34	35
170	237	312	222	239	241	185	######	######	77	1322	242	48	241	34	35

175	237	305	221	236	239	184	######	######	77	1321	244	48	241	34	35
180	239	305	219	234	236	185	######	######	77	1321	245	48	241	34	35
185	238	305	218	232	234	186	######	######	77	1321	246	49	240	34	35
190	237	303	216	231	232	184	######	######	78	1321	247	49	240	33	34
195	240	303	215	229	230	184	######	######	78	1320	248	49	240	33	34
200	235	303	214	228	229	184	######	######	78	1320	248	50	240	33	34
205	231	300	213	226	227	185	######	######	78	1320	248	50	239	33	34
210	229	297	212	225	226	186	######	######	78	1320	248	50	239	33	34
215	223	293	210	223	224	183	######	######	78	1320	248	50	239	33	34
220	219	290	208	221	221	186	######	######	78	1319	248	51	239	33	34
225	215	285	206	218	219	185	######	######	78	1320	248	51	239	32	34
230	211	279	203	215	216	183	######	######	79	1320	248	51	239	32	34
235	208	273	200	212	212	182	######	######	79	1320	248	52	239	32	33
240	203	263	196	209	207	183	######	######	77	1319	248	55	238	32	33

TEMPERATURE DATA SHEET #14A

		TEST TIME	240		
STACK AVG	292	TOP AVG	372	LT SIDE AVG	220
BACK AVG	244	RT SIDE AVG	241	BOTTOM AVG	197
FIREBOX AVG	#######	SEC/CAT AVG	#######	AMBIENT AVG	75

END	211.6	
START	257.6	
	-46.0	DELTA T

CIRCLE: LOSS / GAIN

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 10- 2 -2008 Analyte : CO_2 (15-1)

Unit : Jotul F370 Run # : 2

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO_2 Cyl. Press. : 610 PSI

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

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1600 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % CO_2

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

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

PRE RUN Audit : by : [signature] Time : 1035 Temp : 67 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.002	-.078	-.078	-.311
SPAN	48.8	.488	12.20	48.8	.488	12.220	.020	.082

POST RUN Audit : by : [signature] Time : 1630 Temp : 73 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.028	-.028	-.110
SPAN	48.8	.488	12.20	48.7	.487	12.195	-.005	-.019

± 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 : 10 - 2 - 2008 Analyte : O_2 (15-2)

Unit : Jotul F370 Run # : 2

Zero Cyl. # : 168TAC 3A Conc. : 0.00 % O_2 Cyl. Press. : 610 PSI

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

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1600 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % O_2

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

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

PRE RUN Audit : by : [signature] Time : 1035 Temp : 67 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	-.0003	-.0003	-.0013
SPAN	12.60	.504	12.6	12.6	.504	12.623	.023	.091

POST RUN Audit : by : [signature] Time : 1630 Temp : 73 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	-.0003	-.0003	-.0013
SPAN	12.60	.504	12.6	12.6	.506	12.673	.073	.292

± 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 : 10-2-2008 Analyte : CO (15-3)

Unit : Total F370 Run # : 2

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO Cyl. Press. : 610 PSI

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

Span Cyl. # : C487905 Conc. : 14.90 % CO Cyl. Press. : 1600 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 10.0 % CO

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

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

PRE RUN Audit : by : [signature] Time : 1035 Temp : 67 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.001	.005	.005	.046
SPAN	49.0	.490	4.90	48.7	.487	14.873	-.027	-.275

POST RUN Audit : by : [signature] Time : 1630 Temp : 73 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.015	.015	.146
SPAN	49.0	.490	4.90	48.9	.489	4.892	-.008	-.075

± 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 : 10 - 2 -2008 Analyte : SO_2 (15-4)

Unit : Jotul F370 Run # : 2

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 610 PSI

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

Span Cyl. # : CC82089 Conc. : 1250 ppm SO_2 Cyl. Press. : 1850 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO_2

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

PRE RUN Audit : by : [signature] Time : 1035 Temp : 67 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	4.102	4.102	.164
SPAN	50.0	.500	1250	50.2	.502	1255.4	5.400	.216

POST RUN Audit : by : [signature] Time : 1130 Temp : 73 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	4.102	4.102	.164
SPAN	50.0	.500	1250	50.4	.504	1260.4	10.400	.416

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

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

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

QUALITY CHECKS DATA SHEET # 16

UNIT: Jotul F370 RUN: 2 DATE: 10-2-2008

Thermocouple Check:

T/C # 1	—	°F	T/C # 13	64.8	°F
T/C # 2	—	°F	T/C # 14	64.1	°F
T/C # 3	64.1	°F	T/C # 15	65.0	°F
T/C # 4	62.2	°F	T/C # 16	65.0	°F
T/C # 5	61.6	°F	T/C # 17	66.8	°F
T/C # 6	61.9	°F	T/C # 18	63.2	°F
T/C # 7	61.6	°F	T/C # 19	67.0	°F
T/C # 8	60.4	°F	T/C # 20	—	°F
T/C # 9	—	°F	T/C # 21	—	°F
T/C # 10	—	°F	T/C # 22	—	°F
T/C # 11	59.4	°F	T/C # 23	—	°F
T/C # 12	70.6	°F	T/C # 24	—	°F

Thermocouple Readout:

Pretest zero and span check and calibration			post test zero and span		% difference
ZERO 0.0 °F	Adj. to 0.0 °F		ZERO 1.7 °F	Difference .085 %	
SPAN 2000.3 °F	Adj. to 2000.0 °F		SPAN 1999.7 °F	Difference .015 %	

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.2 °F	400	= 399.8 °F
600	= 599.7 °F	800	= 799.6 °F	1000	= 999.6 °F
1200	= 1199.6 °F	1400	= 1399.4 °F	1600	= 1599.4 °F
1800	= 1799.7 °F	2000	= 2000.0 °F		

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

Scale Check Pre: 380.0 — 370.0 = 10.0

Post: 379.6 — 369.6 = 10.0

Stack Cleaned Prior to Test Run : YES _____ NO X

INSPECTION CERTIFICATE

Phillips Morris Scale Company
Partners in Weighing Systems
934 Elliott Avenue W.
Seattle, WA 98119
Ph#(206)284-6090
Fax#(206)282-6612

CUSTOMER: LOKEE TESTING
ADDRESS: 13235 Prarie Circle
Sumner WA 98390
TECHNICIAN: Patrick McLellan
AUTHORIZATION SIGNATURE:

DATE OF INSPECTION: 11-26-02
NEXT INSPECTION DUE: 5-03
CERTIFICATION TYPE
✓ STANDARD
__ ISO 9000
__ MIL STD-45662

EQUIPMENT TESTED

INDICATOR		BASE	OPTIONS INSTALLED	
MAKE	weightronix		PRINTER	
MODEL	WI-110		SCORE BOARD	
SR#	16409		COMPUTER	
CLASS	III		OTHER	
CAP.	1000 lbs			

PRE-TEST	POST-TEST	MANUFACTURER TOLERANCE
Ø	Ø	
	499.9	
998.7	1000.0	

CORNER TEST P ✓ F __
SHIFT TEST P ✓ F __
STATIC TEST 2 MIN. __ ✓ 5 MIN. __

WEIGHT KIT# _____ NIST# _____

SERIAL NUMBERS OF WEIGHTS USED (OR COPY OF CERTIFICATE)

T23-13 T23-14

ANY CHANGES TO DOCUMENT OR SCALE NOT AUTHORIZED BY PHILLIPS & MORRIS SCALE COMPANY VOIDS THIS CERTIFICATE.

WASHINGTON STATE DEPARTMENT OF **AGRICULTURE**

METROLOGY LABORATORY

Receipt Date:	January 29, 2002	State Test Number:	L2017-1
Test Date:	February 13, 2002	Group ID:	SHOP
Report Date:	February 13, 2002	Due Date:	February 13, 2004

CALIBRATION REPORT

Phillips Morris Scale Company		Item(s) Submitted:	See Table Below
934 Elliott Ave. W		Specification:	NIST HB 105-1, Class F
Seattle, WA 98119-3608		Condition:	Good
Contact:	Todd Mackie	Temperature:	21.0 °C
Phone:	206-284-6090	Pressure:	762.0 mmHg
PO Number:	2-2-009237	Humidity:	35 % RH
SOP:	8	Technician ID:	DW

Description	Value / Range	Qty	Material	Manufacture	Serial Number
Test Weight	1000 lb	5	Cast Iron	Rice Lake	OFT0, OFT1, OFT2, OFSY, OFSZ
Test Weight	500 lb	12	Cast Iron	Rice Lake	T23-13 to T23-16, T23-20, T23-24, T23-26, T23-28 to T23-32
Test Weight	50 lb	30	Cast Iron	Rice Lake	877B, N1039, N1041, T23-1 to T23-10, T23-19 to T23-28, WA171-0, WA1712-0 to WA172-2, WA173-2, WA237, X694
Test Weight	25 lb	2	Cast Iron	Rice Lake	WA238, T23-11
Weight Set, 7 pc	10 lb - 8 oz	1	Stainless Steel	Rice Lake	WA177-7
Weight Set, 12 pc	5 kg - 200 g	1	Stainless Steel	Rice Lake	SK

The item(s) listed above have been found and/or left within the stated tolerances for the specification stated above, except as noted. The item(s) listed above have been compared to the Standards of the State of Washington, which are currently in control. These standards values are traceable to the National Institute of Standards and Technology (NIST) through NIST Test Numbers 822/264514-01 and Minnesota Metrology Laboratory Report Number 307 430. Calibration processes were monitored and found to be in control. The expanded uncertainty (k=2) for each item listed in this report is less than 1/3 of the appropriate tolerance. Results apply to items identified in this report only. This report may not be reproduced, except in full, unless permission for the publication of an abstract is obtained in writing from the calibrating organization issuing this report.

LABORATORY SERVICES DIVISION
WEIGHTS AND MEASURES PROGRAM

Dan Wright

DAN WRIGHT
STATE METROLOGIST

MAR 0 8 2002

NVLAP

NVLAP LAB CODE 200446-0

2747 29th Avenue Southwest ▼ Tumwater, Washington 98512 ▼ (360) 753-5042 ▼ (360) 586-4728 fax

Established 1974

QUALITY CONTROL SERVICES

LABORATORY AND METROLOGY EQUIPMENT: SALES AND SERVICE
2340 S.E. 11th Avenue • Portland, Oregon 97214
P.O. Box 14831 • Portland, Oregon 97293 • (503) 236-2712 • FAX: (503) 235-2535

okee Testing Labs
13235 Prairie Circle East
umner, WA 98390

Report Number: LOKT0137010004080505

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	A120S	37010004	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
g	0.0001	QC012	5/5/08	11/27/07	11/2008

FUNCTIONAL CHECKS

ECCENTRICITY	LINEARITY	REPEATABILITY
Test Wt: 100 / Tol: 0.0003	Test Wt: 50x2 / Tol: 0.0004	Test Wt: 100 / Tol: 0.0001
As-Found: Pass: ☑ Fail: ☐	As-Found: Pass: ☑ Fail: ☐	As-Found: Pass: ☑ Fail: ☐
As-Left: Pass: ☑ Fail: ☐	As-Left: Pass: ☑ Fail: ☐	As-Left: Pass: ☑ Fail: ☐

CALIBRATION DATA

Standard	As-Found	As-Left
100	100.0002	100.0001
70	70.0002	70.0001
50	50.0001	50.0001
20	20.0000	20.0000
10	10.0000	10.0000
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	1MG-25KG	A45	5/7/07	8/2008	822/274334-07

F rmanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

T chnician: D. Deleasa

Signature: D. Deleasa

THIS CERTIFICATE SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE APPROVAL OF QUALITY CONTROL SERVICES, INC.

Ir uments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

Established 1974

QUALITY CONTROL SERVICES

LABORATORY AND METROLOGY EQUIPMENT: SALES AND SERVICE
2340 S.E. 11th Avenue • Portland, Oregon 97214
P.O. Box 14831 • Portland, Oregon 97293 • (503) 236-2712 • FAX: (503) 235-2535

Lokee Testing Labs
13235 Prairie Circle East
Sumner, WA. 98390
Chip Wadington

Report Number: EESPC37010004071127

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	A120S	37010004	N/A	Lab

Units	Readability	SOP Used	Cal. Date	Last Cal.	Cal. Due
Grams	0.0001	QC004	11/27/2007	05/14/2007	05/2008

FUNCTIONAL CHECKS

ECCENTRICITY:	LINEARITY:	REPEATABILITY:
Test Wt: 100 Tol: 0.0003	Test Wt: 50x2 Tol: 0.0004	Test Wt: 100 Tol: 0.0001
AS FOUND: Pass: ☑ Fail: ☐	AS FOUND: Pass: ☑ Fail: ☐	AS FOUND: Pass: ☑ Fail: ☐
AS LEFT: Pass: ☑ Fail: ☐	AS LEFT: Pass: ☑ Fail: ☐	AS LEFT: Pass: ☑ Fail: ☐

CALIBRATION DATA

Standards	As Found	As Left
100	100.0006	100.0002
70	70.0004	70.0001
50	50.0003	50.0001
20	20.0000	20.0000
10	10.0000	10.0001
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal. Date	Cal. Due	Traceable ID#
Weight Set	R.L./Troemner	1MG-25KG	A45	05/07/2007	08/2008	822/274334-07

Comments / Info Concerning This Calibration:

Permanent Information Concerning This Instrument:

Technician: D.Deleasa

Signature: D. Deleasa

THIS CERTIFICATE SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE WRITTEN APPROVAL OF QUALITY CONTROL SERVICES, INC.

INSTRUMENT(S) LISTED ABOVE WERE CALIBRATED USING STANDARDS TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (N.I.S.T.).

Established 1974

QUALITY CONTROL SERVICES

LABORATORY AND METROLOGY EQUIPMENT: SALES AND SERVICE
2340 S.E. 11th Avenue • Portland, Oregon 97214
P.O. Box 14831 • Portland, Oregon 97293 • (503) 236-2712 • FAX: (503) 235-2535

Lokee Testing Labs
13235 Prairie Circle East
Sumner, WA. 98390
Chip Wadington

Report Number: EESPC37010004070514

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	A120S	37010004	N/A	Lab

Units	Readability	SOP Used	Cal. Date	Last Cal.	Cal. Due
Grams	0.0001	QC004	05/14/2007	12/08/2006	11/2007

FUNCTIONAL CHECKS

ECCENTRICITY:	LINEARITY:	REPEATABILITY:
Test Wt: 100 Tol: 0.0003	Test Wt: 50x2 Tol: 0.0004	Test Wt: 100 Tol: 0.0001
AS FOUND: Pass: ☑ Fail: ☐	AS FOUND: Pass: ☑ Fail: ☐	AS FOUND: Pass: ☑ Fail: ☐
AS LEFT: Pass: ☑ Fail: ☐	AS LEFT: Pass: ☑ Fail: ☐	AS LEFT: Pass: ☑ Fail: ☐

CALIBRATION DATA

Standards	As Found	As Left
100	100.0008	100.0001
70	70.0005	70.0001
50	50.0004	50.0001
20	20.0001	20.0000
10	10.0001	10.0001
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal. Date	Cal. Due	Traceable ID#
Weight Set	R.L./Troemner	1MG-25KG	A45	06/14/2006	09/2007	822/272027-5

Comments / Info Concerning This Calibration:

Permanent Information Concerning This Instrument:

Technician: D.Deleasa

Signature: D. Deleasa

THIS CERTIFICATE SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE WRITTEN APPROVAL OF QUALITY CONTROL SERVICES, INC.

INSTRUMENT(S) LISTED ABOVE WERE CALIBRATED USING STANDARDS TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (N.I.S.T.).

Thermocouple Calibration Record Semi-Annual

Thermocouples Check against
Reference Thermometer serial number 9123454
Ice Water Bath 32.0
Boiling Water 212.0
Room Temperature 71
Barometric Pressure 30.07
DATE: 6-3-2008

TC	Location	Ice Bath Temp	Boiling Water Temp
1	Wet Bulb	32.0	212.0
2	Dry Bulb	32.0	212.0
3	Stack	32.4	210.9
4	Stove Top	32.1	211.7
5	Left Side	32.1	211.6
6	Back	32.0	211.1
7	Right Side	32.5	209.9
8	Bottom	32.1	211.4
9	Firebox	33.0	211.9
10	Secondary/Cat	31.9	212.1
11	Ambient	32.1	211.9
12	Tube Furnace	33.6	212.9
13	Sample Box	32.2	211.7
14	Impinger Out	32.0	211.6
15	C. Gas Box	32.1	212.1
16	C. Gas Out	31.8	212.0
17	SO2 Out	32.4	211.9
18	Upper Ambient	32.2	211.1
19			
20			
21			
22			
23	Calibrator	32.0	212.0
24	Oven	32.0	211.3

Thermocouple Readout Semi-Annual Calibration Data Sheet

Date: 6-3-2008
Ambient Temperature: 71
Technician: CPW.

Thermocouple Number: T/C Readout
Barometric Pressure: 30.07
Reference: Mercury in glass FISHER #9123454
Other: OMEGA CL-300

Reference Point No. [a]	Source [b]	Reference Thermometer Temperature °F	Thermocouple Potentiometer Temperature °F	Difference (%)[c]
32	Ice Water	32.0	32.0	Ø
212	Boiling Water	212.0	212.0	Ø
250	Omega	250.0	249.9	.04
300	Omega	300.0	299.9	.033
400	Omega	400.0	399.8	.05
500	Omega	500.0	499.8	.04
600	Omega	600.0	599.7	.05
700	Omega	700.0	699.7	.043
800	Omega	800.0	799.7	.038
900	Omega	900.0	899.8	.022
1000	Omega	1000.0	999.7	.030
1200	Omega	1200.0	1199.7	.025
1400	Omega	1400.0	1399.8	.014
1600	Omega	1600.0	1599.8	.013
1800	Omega	1800.0	1799.9	.006
2000	Omega	2000.0	2000.0	Ø

[a] Every 50°F for each reference point
[b] Type of Calibration System Used
[c] $\frac{\text{(reference temperature) - (thermocouple temperature)}}{\text{reference temperature}} * 100$

TRACEABILITY DOCUMENTATION Semi-Annual

S02 INJECTION ROTAMETER, DRY GAS METER AND SLING PSYCHROMETER THERMOMETERS IN LAB. CHECKED AGAINST FISHER SN 9123454 (NIST).

DATE: 6-3-2008

SO^2 INJECTION ROTAMETER FISHER SN 9123454

Actual	°C = °F	NIST Traceable °F
0.0	32.0	32.0
21.2	70.2	70.0
36.8	98.2	98.0
45.6	114.1	113.9

DRY GAS METER THERMOCOUPLES

Actual	°C = °F	5H in	5H out	KK
0.0	32.0	32.2	32.0	32.0
20.8	69.4	69.9	69.5	69.4
35.8	96.4	96.1	96.5	96.3
45.0	113.0	113.0	112.7	112.9

SLING PSYCHROMETER

Actual	°C = °F	Wet Bulb	Dry Bulb
0.0	32.0	32.0	32.0
20.6	69.1	69.0	69.0
35.0	95.0	95.0	95.0
43.8	110.8	110.8	110.8

Conversions = °F = (°C × 1.8) + 32 °C = (°F-32)÷1.8

VANEOMETER CALIBRATION

LoKee Testing Lab uses a Dwyer Model #480 Vaneometer to measure test chamber air velocity. The manufacturer's specifications for accuracy are ± 5.0% to 100 FPM and ± 10% from FPM to top of scale. LoKee Testing Lab insures that the instrument is level and clean prior to taking each reading. According to EPA personnel (Westlin, RTP) no further calibration of the instrument is necessary.

DRAFT GAUGE CALIBRATION

LoKee Testing Lab uses a Dwyer model 115-AV 0-0.25" inclined water manometer (readability resolution ± 0.001" of water) to measure the static pressure in the stack. Once leveled and zeroed as per the manufacturer's written operating instructions, the Dwyer manometer is a primary standard and requires no additional calibration.

The manometer is leveled and zeroed at the start of each test run, checked as necessary during the run to verify the settings have not changed and again at the end of each test run. The results of each check are recorded on Data Sheet #16 in each test run.

BAROMETER CALIBRATION

LoKee Testing Lab uses a Princo Model 469 NOVA Mercury Barometer to measure barometric pressure. When installed and maintained as per the manufacturer's written operating instruction, the Princo Model 469 Mercury Barometer is a primary standard and needs no further calibration.

MOISTURE METER CALIBRATION

The Delmhorst Model RC-1C, SN 16152 Moisture Meter is calibrated each time the meter is used by adjusting the zero and span calibration. The potentiometers of each calibration point (X = zero, Y = span) are adjusted until the meter is calibrated correctly. The meter is then checked against a calibration block (Delmhorst Model MCS-1, moisture content standard at 12.0% and 22.0%) in its normal operating range of 11-25%.

LoKee Testing Lab also has a second moisture meter, Delmhorst Model G-30, SN 2477 to use as a backup.

POST TEST METER BOX AUDIT DATA SHEET # 32

UNIT: Jotul F370 DATE: 10-7-2008

TEST DATA

RUN #	1	2	3	4	5	6	7	8	9	10
AVG. ΔH	.104	.150	.164	.186						
MAX VAC	2.0	3.0	2.0	3.0						

Avg. Test Series ΔH: .151 in H_2O Test Series Max Vac: 3.0 in Hg

Audit Dry Gas Meter: K2 Correction (Y) Factor: 1.019 (mcf)

Test Dry Gas Meter: H Correction (Y) Factor: .940 (mcf)

AUDIT DATA

		Audit # 1	Audit #2	Audit #3
BP		30.01	30.01	30.01
VAC		3.0	3.0	3.0
AUDIT METER :				
VOL.	Final	944.802	949.545	954.343
(Vw)	Initial	940.100	944.802	949.545
	Vol.	4.702	4.743	4.798
TEMP (°F)	Initial	67	75	81
(Tw)	Mid	71	78	82
	Final	75	81	83
(°F / °A)	**Avg.**	531	538	542
ΔH	Initial	.151	.151	.151
	Mid	.151	.151	.151
	Final	.151	.151	.151
	Avg.	.151	.151	.151
DRY GAS METER :				
VOL.	Final	365.000	370.000	375.000
(Vd)	Initial	360.000	365.000	370.000
	Vol.	5.000	5.000	5.000
TEMP (°F)	Initial	65	69	71
(Tm)	Mid	67	70	73
	Final	69	71	73
(°F / °A)	**Avg.**	527	530	533

$$Y = \frac{(Vw)(mcf)(BP)(Tm)}{(Vd)\left(BP + \frac{DH}{13.6}\right)(Tw)}$$

$$\text{Y Factor \% Diff.} = \frac{\text{Act} - \text{Exp}}{\text{Exp}} \times 100$$

NOTE : mcf = meter correction (Y) factor for Dry Gas Meter used as a transfer standard

RUN 1

$$Y = \frac{(4.702)(1.019)(30.01)(527)}{(5.000)\left(30.01 + \frac{.151}{13.6}\right)(531)} = \frac{75776.30}{79706.03} = .951$$

$$\Delta\% = \frac{(.951 - .924)}{.924} \times 100 = 2.922\ \%$$

RUN 2

$$Y = \frac{(4.743)(1.019)(30.01)(530)}{(5.000)\left(30.01 + \frac{.151}{13.6}\right)(538)} = \frac{76872.18}{80756.77} = .952$$

$$\Delta\% = \frac{(.952 - .924)}{.924} \times 100 = 3.030\ \%$$

RUN 3

$$Y = \frac{(4.798)(1.019)(30.01)(533)}{(5.000)\left(30.01 + \frac{.151}{13.6}\right)(542)} = \frac{78203.76}{81357.19} = .961$$

$$\Delta\% = \frac{(.961 - .924)}{.924} \times 100 = 4.004\ \%$$

NOTE : The Y factor % difference must be < ± 5.0 % to be acceptable

INTERPOLATED Y FACTOR

.1 (A) inch H_2O ΔH = .930 (C) — Calculated calibration Y factor from calibrations

.2 (B) inch H_2O ΔH = .919 (D) — Calculated calibration Y factor from calibrations

.2 (B) - .1 (A) = .1 X 100 = 10 (E)

.919 (D) - .930 (C) = -.011 + 10 (E) -.0011 (F)

.151 Avg ΔH - .1 (A) = .051 X 100 = 5.1 (G)

[-.0011 (F) X 5.1 (G)] + .930 (C) = .924 Interpolated Y factor

Volume Metering System Leak Check : 0.000 inch H_2O in one minute

DRY GAS METER CALIBRATION

DATE : 6-2-2008 DRY GAS METER : H BOX : 5

BAROMETRIC PRESSURE 29.88 in. Hg.				Wet Test Meter Correction Factor Y= 1.019			
Orifice Manometer Setting, ΔH, in. H_2O		.1	.2	.3	.5	.75	1.0
Gas Volume Wet Test Meter Vw ft^3	Final	898.183	905.770	910.453	920.270	925.022	929.780
	Initial	893.500	898.183	905.770	910.453	920.270	925.022
	Vw ft^3	4.683	7.587	4.683	9.817	4.752	4.758
Gas Volume Dry Test Meter Vd ft^3	Final	510.100	518.400	523.400	533.800	538.800	543.800
	Initial	505.000	510.100	518.400	523.400	533.800	538.800
	Vw ft^3	5.100	8.300	5.000	10.400	5.000	5.000
Wet Test Meter Temperature tw	Initial	84	92	96	98	98	98
	Middle	88	94	97	98	98	98
	Final	92	96	98	98	98	98
	Average	548	554	557	558	558	558
Dry Test Meter Temperature tm	Initial	84	85	87	88	89	91
	Middle	85	86	88	89	90	91
	Final	85	87	88	89	91	92
	Average	85 545	547	548	549	550	551
$Y = \frac{(W_{mcf})(Vw)(Pb)(tm)}{Vd\left(Pb + \frac{\Delta H}{13.6}\right)(tw)}$		77709.74 / 83529.17 .930	126360.7 / 137461.8 .919	78137.50 / 83277.23 .938	164099.0 / 173613.0 .945	79578.2 / 83519.1 .953	79823.5 / 83570.3 .955

Average Y= .940

METER BOX CALIBRATION

Date : 8/24/2007
Calibrated By : JG
Dry Gas Meterbox ID : Lokee

Barometric Pressure, Pb = 27.42 in. Hg
Vacuum = 0 in. Hg

Orifice Manometer Setting, Delta H in. H20		0.1	0.2	0.3	0.5	0.75	1
Gas Volume Wet Test Meter Vw, cu. ft.		1	1	1	2.003	3.002	4.003
Gas Volume Dry Gas Meter	M Final	387.481	397.924	408.43	418.834	429.056	439.171
	M Initial	377.481	387.914	398.422	408.879	419.155	429.321
	Vd, cu. ft.	0.966	0.958	0.952	1.909	2.881	3.945
Wet Test Meter tw	Deg F	87	84	82	82	82	84
tw	Deg A	547	544	542	542	542	544
Dry Gas Meter Outlet,	tmo 1	85	74	68	68	80	80
	2)	85	74	68	76	80	80
	3)	89	74	68	76	80	80
Dry Gas Meter Inlet	tmi 1	87	83	80	81	82	85
	2)	88	83	80	82	82	86
	3)	88	85	83	82	82	86
Mean tm, Deg F		87	78.8	74.5	77.5	81	82.8
Mean tm, Deg A		547	538.8	534.5	537.5	541	542.8
Time, Minutes		5.85	3.74	2.96	4.6	5.82	6.78
Results :							
	Y =	0.997	0.997	1.035	1.039	1.038	1.01
		0.022	0.022	-0.016	-0.02	-0.019	0.009
	Delta H @	1.8	1.78	1.67	1.67	1.77	1.81
		-0.05	-0.03	0.08	0.08	-0.02	-0.06

Averages :

Y = 1.019 K2

Delta H = 1.75

WET TEST METER CALIBRATION LOG

Wet Test Meter Serial Number AA455 Date 12-1-2007

Range of Wet Test Meter Flow Rate 0 - 0.25

Volume of Test Flask Vs 37.850

Satisfactory Leak Check? Yes

Ambient Temperature of Equilibrate Liquid in Wet Test Meter and Reservoir 71

TEST #	MANOMETER READING, *a* mm H_2O	FINAL VOLUME (Vf), l	INITIAL VOLUME (Vi), l	TOTAL VOLUME (Vm), *b* l	FLASK VOLUME (Vs), l	PERCENT ERROR, *c* %
1	Ø	3.0	Ø ALL RESET	3.0	3.002	-.067
2	Ø	3.0	Ø	3.0	3.001	-.033
3	Ø	3.0	Ø	3.0	3.002	-.067

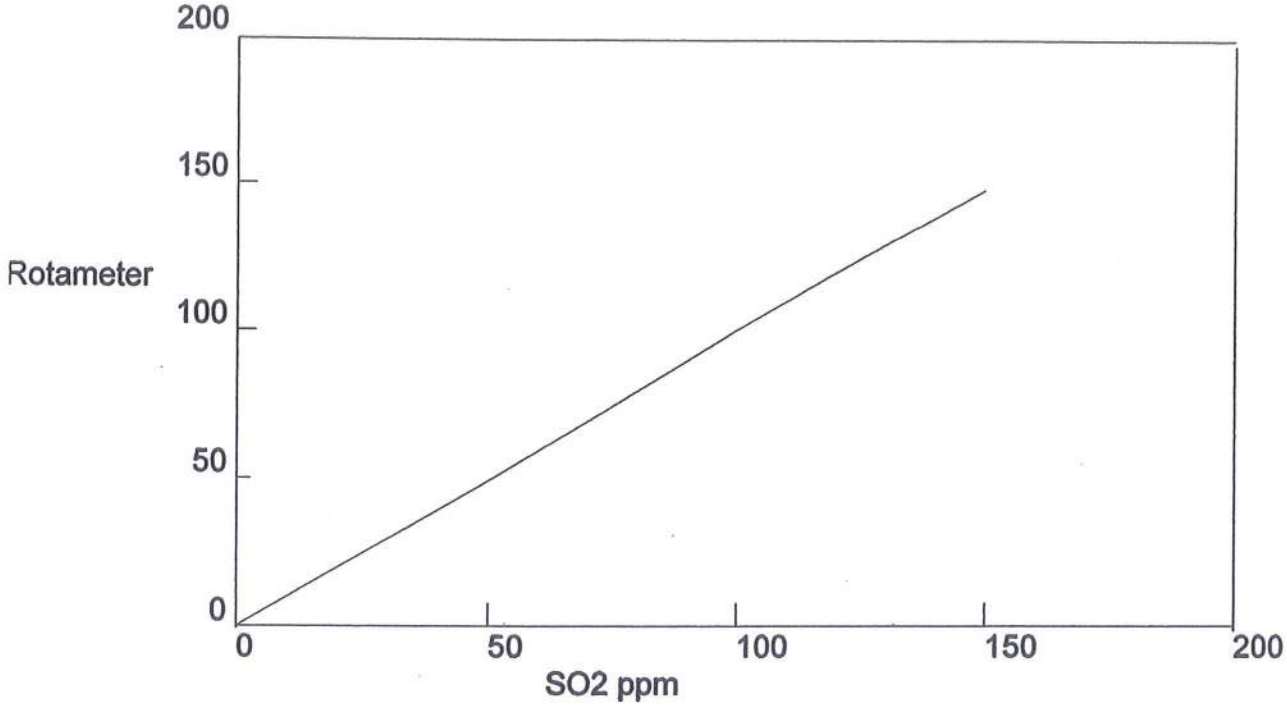
a - Must be less than 10 mm H_2O (0.4 ' H_2O)

Calculations:

b - Vm - Vf - Vi

c - % error = $\frac{100(V_m - V_s)}{V_s}$ = -.056 (± 1 %)

SO2 Rotameter
06/04/08



Regression Output:

Constant	0.18
Std Err of Y Est	5.2878634627
R Squared	0.9966552605
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	1.1546
Std Err of Coef.	0.0472960886

SO_2 ROTAMETER CALIBRATION

Last Cal. : 11-12-2007 By : Cp Date : 6-4-2008 By : Cp

Manufacturer : SKC-WEST
SKC ACCUFLOW Digital Flow Calibrator: Model 712 SN : 311325

Barometric Pressure : 30.13 " Hg Temperature : 72

RUN #	50 CC/MINUTE DIGICAL VOLUME	100 CC/MINUTE DIGICAL VOLUME	150 CC/MINUTE DIGICAL VOLUME
1	55.0	121.7	170.0
2	55.2	121.9	170.5
3	54.8	121.5	170.4
4	55.1	121.6	170.1
5	55.3	122.0	170.0
6	55.2	121.8	170.7
7	54.9	121.7	170.2
8	55.0	122.0	169.9
9	55.1	121.8	170.1
10	55.1	121.6	170.2
AVERAGE	55.1 cc/min	121.8 cc/min	170.2 cc/min

SETTING	cc/min
0	0.0
50	55.1
100	121.8
150	170.2

Rotometer setting for 100 cc/minute based on regression with this data.

100 CC / MINUTE = 86.4

TRACER GAS TRAIN RESPONSE TIME

DATE: 6-4-2008

Elapsed Time	SO_2 Conc. (v.)	SO_2 Conc. (v.)	SO_2 Conc. (v.)
00 sec	.493	.490	.490
15	.334	.342	.341
30	.172	.180	.169
45	.046	.070	.065
60	.017	.019	.017
75	.004	.003	.003
90	.001	.001	.000
105	.000	.000	
120			
135			
150			
165			
180			
Initial Response	7	7	7
95 % Response	55	55	55
Flow Rate	1.5	1.5	1.5

CEM GAS TRAIN RESPONSE TIME

Elapsed Time	CO_2 Conc. (v.)	CO_2 Conc. (v.)	CO_2 Conc. (v.)	O_2 Conc. (v.)	O_2 Conc. (v.)	O_2 Conc. (v.)	CO Conc. (v.)	CO Conc. (v.)	CO Conc. (v.)
00 sec	.485	.485	.486	.000	.000	.000	.491	.491	.491
15	.485	.486	.485	.392	.400	.390	.243	.245	.245
30	.421	.418	.420	.688	.692	.699	.071	.065	.066
45	.180	.181	.180	.770	.775	.775	.011	.009	.009
60	.091	.095	.092	.815	.816	.815	.002	.001	.001
75	.042	.047	.045	.821	.823	.822	.000	.000	.000
90	.027	.025	.026	.825	.827	.827			
105	.018	.019	.018	.828	.829	.828			
120	.007	.009	.007						
135	.004	.005	.004						
150	.002	.002	.002						
165	.001	.001	.001						
180	Ø	Ø	Ø						
Initial Response	19	18	19	6	6	6	6	6	6
95 % Response	95	95	95	50	50	50	40	40	40
Flow Rate	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

ORSAT ANALYSIS DATA SHEET

DATE : 6-4-08

Gas	1	2	3	AVE	CONC	TANK ID
CO_2	Ø	Ø	Ø	Ø	Ø	1L8TAC 3A
O_2	Ø	Ø	Ø	Ø	Ø	
CO	Ø	Ø	Ø	Ø	Ø	
CO_2					12.2	487905
O_2					12.6	NEW 11-01-07
CO					4.90	Exp 10-31-2012
CO_2					21.1	CA06641
O_2					20.9	
CO					8.63	Exp 1-5-2012
CO_2	6.2	6.2	6.2	6.2	6.22	CC-12730
O_2	6.2	6.2	6.2	6.2	6.25	
CO	2.0	2.0	2.0	2.0	1.98	
CO_2						
O_2						
CO						

CO_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 10-1-2008

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

Calibration by: CpWardwright

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 30.03 Instrument ID: PRINCO

Temp: 73 Instrument ID: TR

Cylinders:

1. # 168TAC 3-A Concentration: 00.00 % CO_2 Cyl. Press.: 620 PSI
   Certified by: AIR LIQUIDE Date: 04-19-04
2. # 487905 Concentration: 12.20 % CO_2 Cyl. Press.: 1630 PSI
   Certified by: AIR LIQUIDE Date: 11-1-07
3. # CA06641 Concentration: 21.1 % CO_2 Cyl. Press.: 1540 PSI
   Certified by: AIR LIQUIDE Date: 1-5-2007
4. # CC-12731 Concentration: 6.22 % CO_2 Cyl. Press.: 1110 PSI
   Certified by: AIR LIQUIDE Date: 03-13-03

Analyzer: **Calibrated Range:** 0-25.0 % **Output:** 0-1.0 V.
Flow: 1.5 SCFH **Measured by:** Rotameter

Calibration Results

Point #	CYL. #	% CO2	EXPECTED METER	EXPECTED DVM	ACTUAL METER	ACTUAL DVM	ADJ. METER	ADJ. DVM
1	1	0.00	00.0	.000	00.0	.000	00.0	.000
2	2	12.20	48.8	.488	48.0	.480	48.8	.488
3	3	21.1	84.4	.844	84.1	.841		
4	4	6.22	24.9	.249	25.0	.250		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 12.522

CO_2 Linear Regression Results:

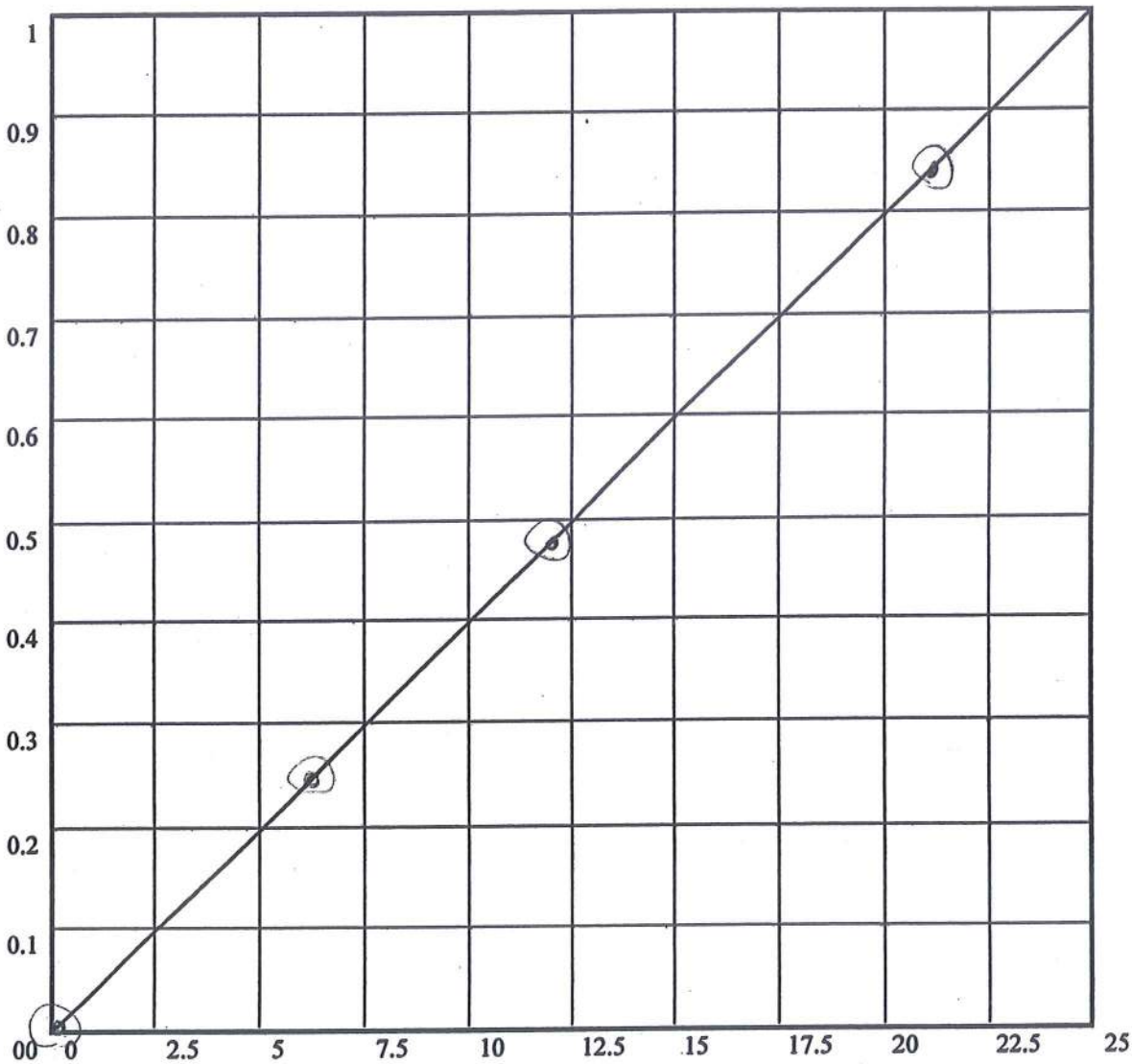
Y = MX +B

Slope (M) = .0011017

Y Intercept (B) = .0398429

Correlation Coefficient (r) = .9999953

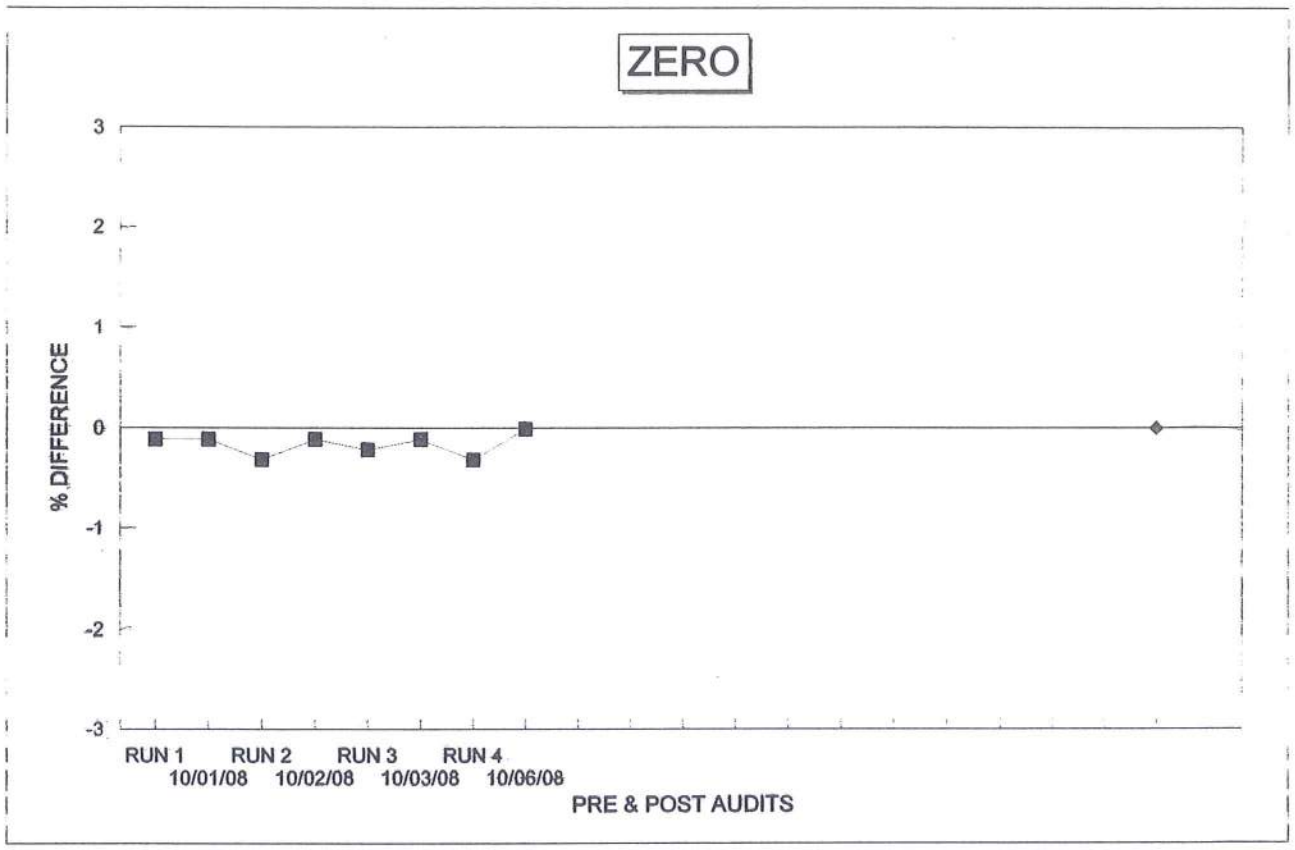
r^2 = .9999905

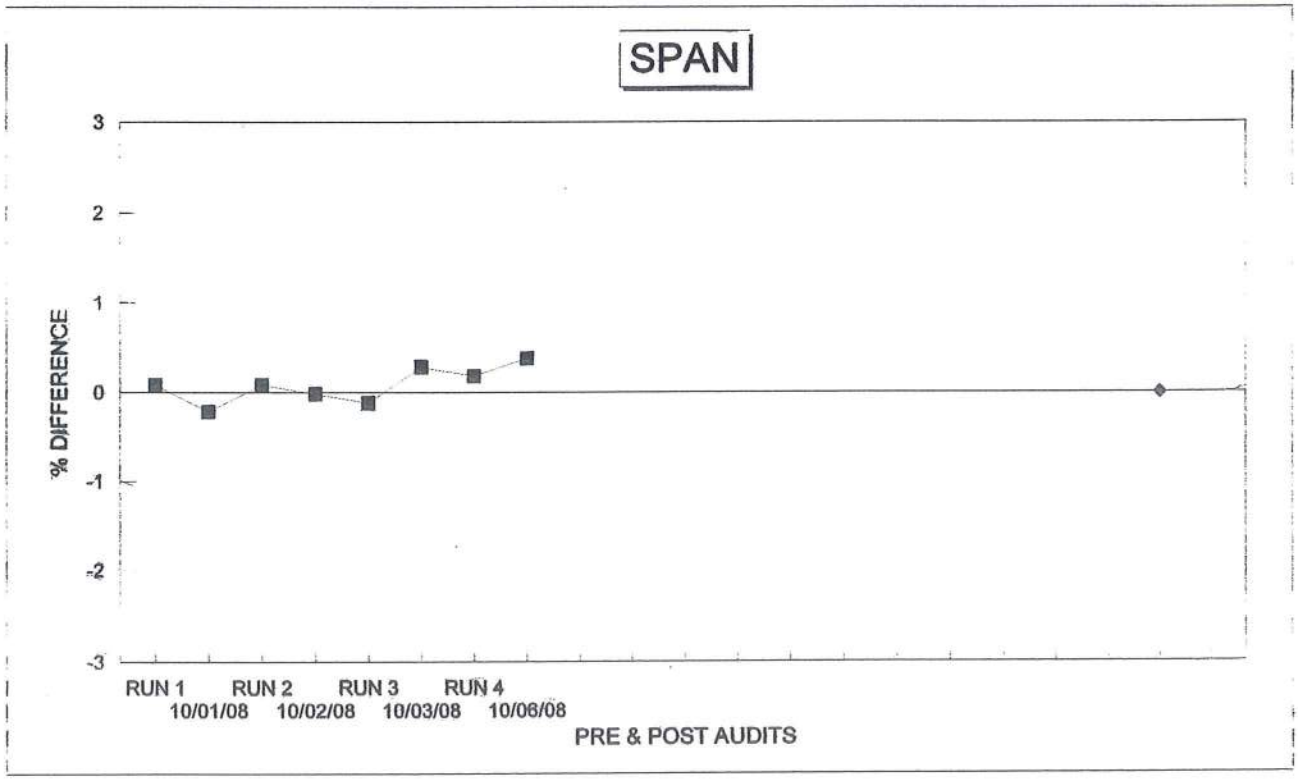


EPA Span Value = ± 2.0% of 25% CO_2 = ± .5%

Cal Volts = Cal Volt Conc - Std Conc = ± Conc Diff = ± Δ %

HIGH VOLTS	.841	=	21.025	-	21.1	=	-.075	=	-.300
LOW VOLTS	.250	=	6.25	-	6.22	=	.030	=	.120


ZERO
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1
10/01/08
RUN 2
10/02/08
RUN 3
10/03/08
RUN 4
10/06/08
PRE & POST AUDITS


SPAN
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1
10/01/08
RUN 2
10/02/08
RUN 3
10/03/08
RUN 4
10/06/08
PRE & POST AUDITS

O_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 10-1-2008

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

Calibration by: Cp Wadington

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 30.03 Instrument ID: PRINCO

Temp: 73 Instrument ID: TR

Cylinders:

1. # 168TAC 3-A Concentration: 00.00 % O_2 Cyl. Press.: 620 PSI
   Certified by: AIR LIQUIDE Date: 04-19-04
2. # 487905 Concentration: 12.0 % O_2 Cyl. Press.: 1630 PSI
   Certified by: AIR LIQUIDE Date: 11-1-07
3. # CA06641 Concentration: 20.9 % O_2 Cyl. Press.: 1540 PSI
   Certified by: AIR LIQUIDE Date: 1-5-2007
4. # CC-12731 Concentration: 6.25 % O_2 Cyl. Press.: 1110 PSI
   Certified by: AIR LIQUIDE Date: 03-13-03

Analyzer: **Calibrated Range:** 0-25.0 % **Output:** 0-1.0 V.
Flow: 1.5 SCFH **Measured by:** Rotameter

Calibration Results

Point #	CYL. #	% O2	EXPECTED METER	EXPECTED DVM	ACTUAL METER	ACTUAL DVM	ADJ. METER	ADJ. DVM
1	1	0.00	00.0	.000	00.0	.000	00.0	.000
2	2	12.60	12.60	.504	12.5	.501	12.6	.504
3	3	20.9	20.9	.836	20.8	.833		
4	4	6.25	6.25	.250	6.3	.251		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 12.522

O_2 Linear Regression Results:

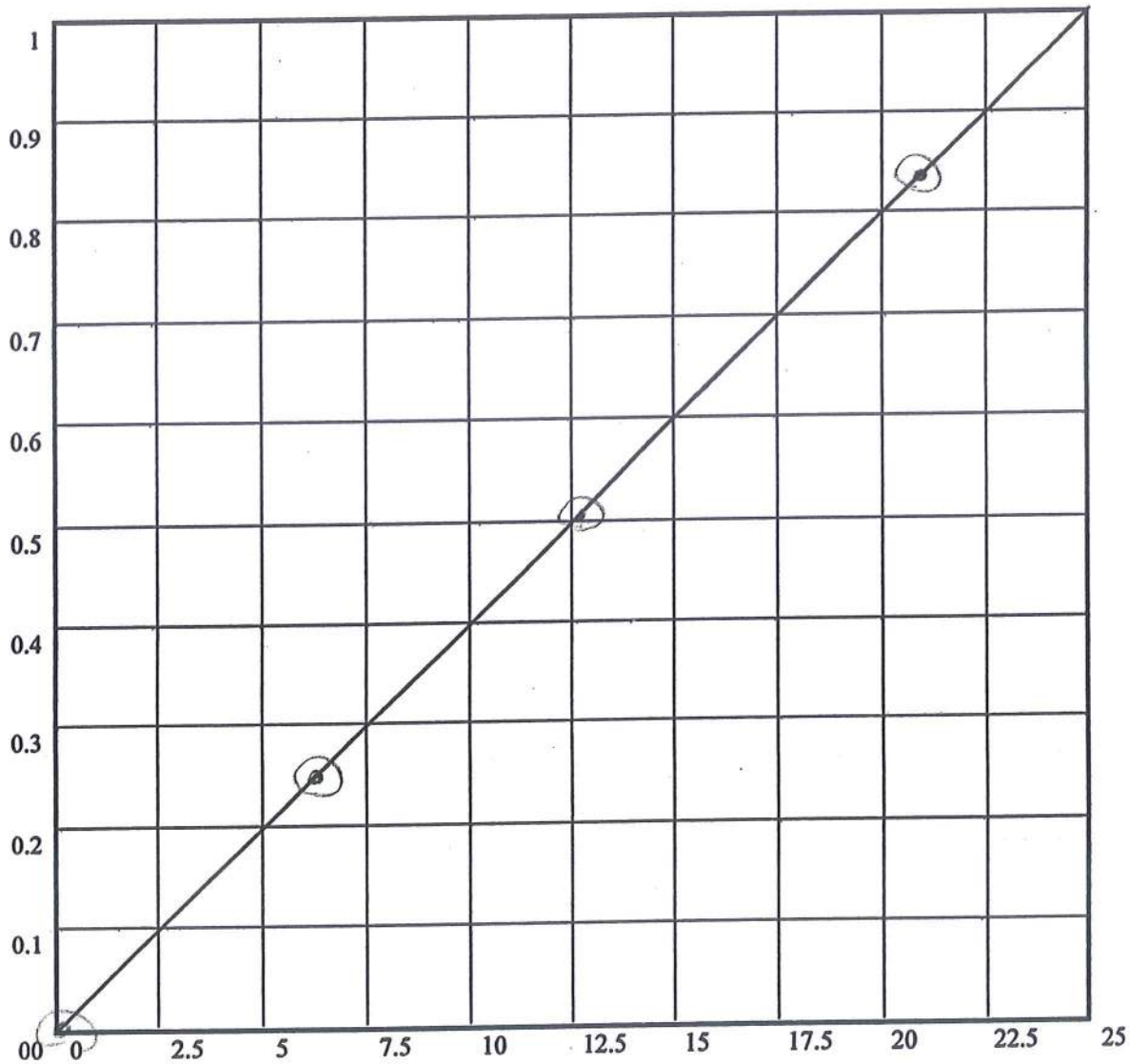
Y = MX +B

Slope (M) = .0010169

Y Intercept (B) = .0398474

Correlation Coefficient (r) = .9999955

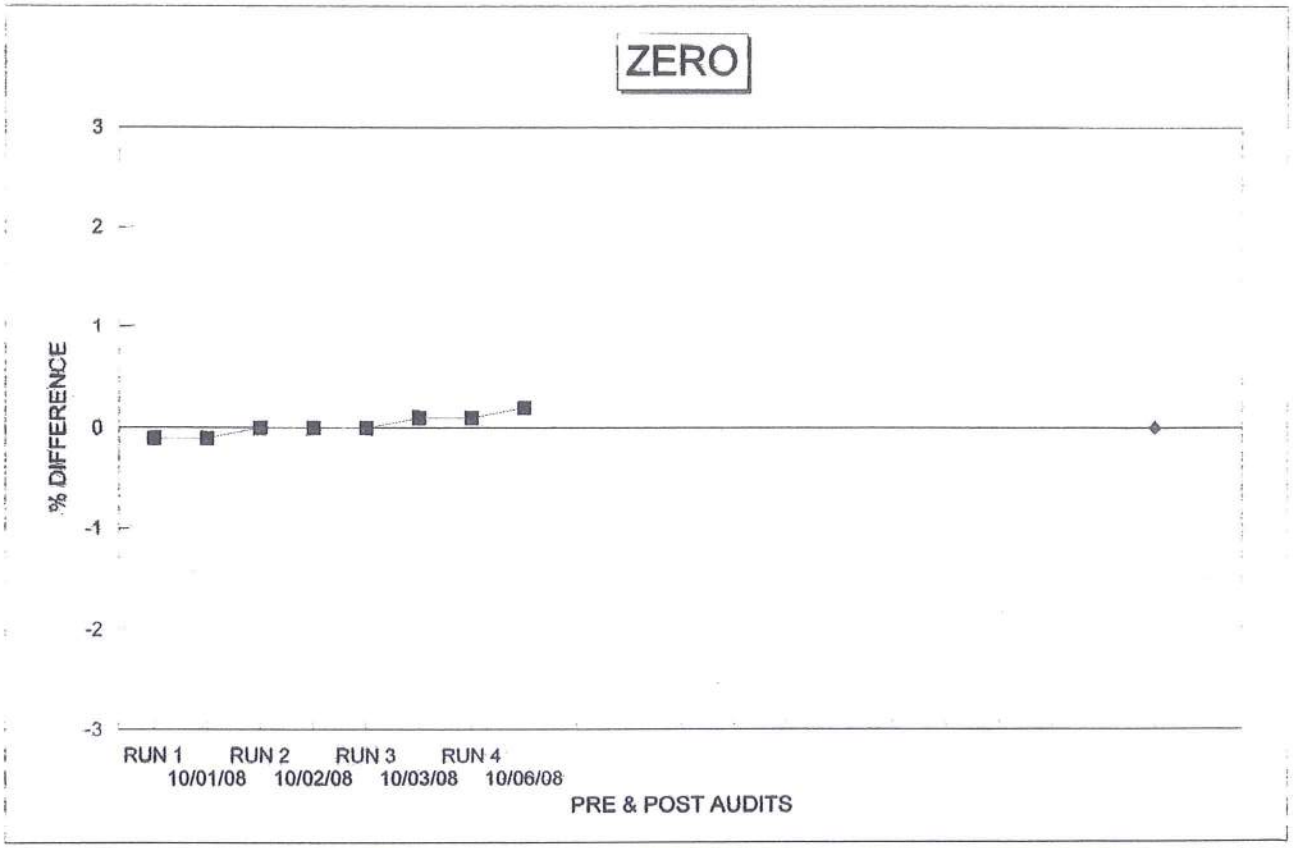
r^2 = .9999910

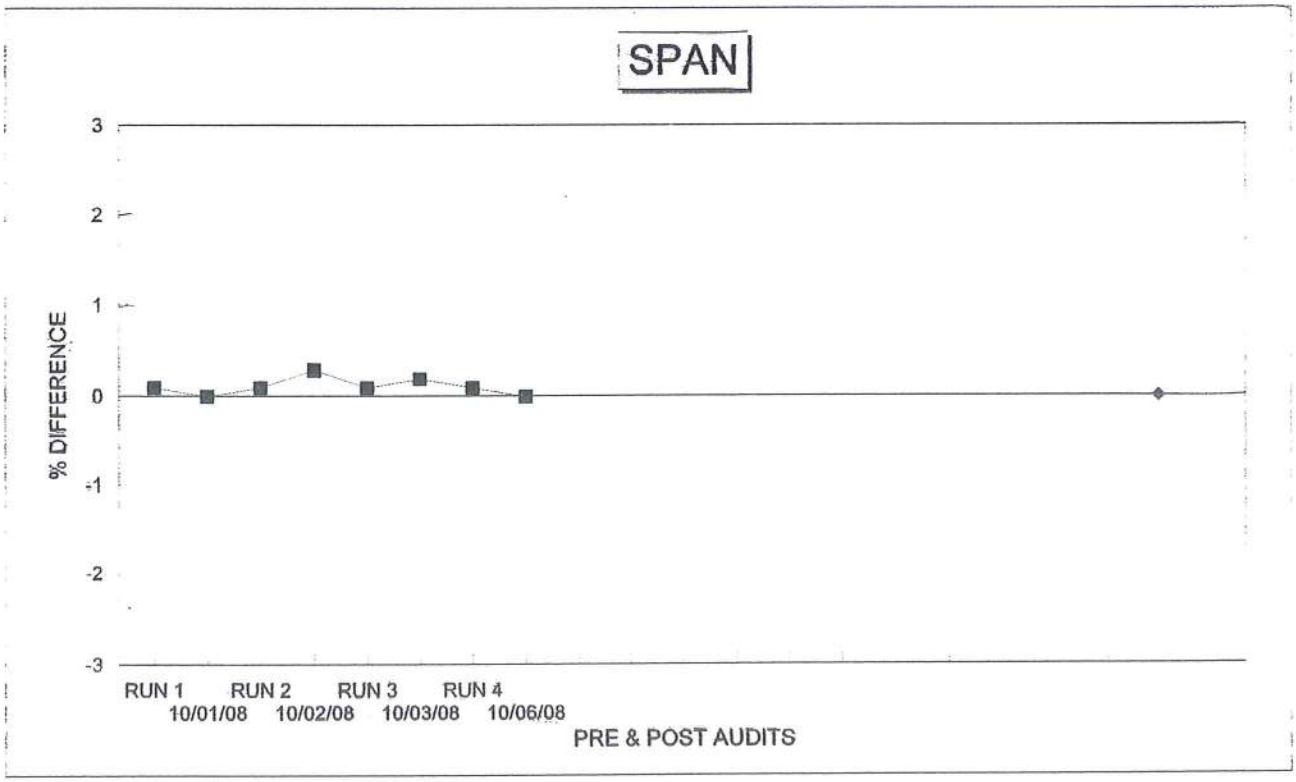


EPA Span Value = ± 2.0% of 25% O_2 = ± .5%

Cal Volts = Cal Volt Conc - Std Conc = ± Conc Diff = ± Δ %

HIGH VOLTS	.833	=	20.825 -	20.9	= -.075	=	-.300
LOW VOLTS	.251	=	6.275 -	6.25	= .025	=	.100


ZERO
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1
10/01/08
RUN 2
10/02/08
RUN 3
10/03/08
RUN 4
10/06/08
PRE & POST AUDITS


SPAN
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1
10/01/08
RUN 2
10/02/08
RUN 3
10/03/08
RUN 4
10/06/08
PRE & POST AUDITS

CO ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 10-1-2008

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

Calibration by: Chp Wentworth

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 30.03 Instrument ID: PRINCO

Temp: 73 Instrument ID: TR

Cylinders:

1. # 168TAC 3-A Concentration: 00.00 % CO Cyl. Press.: 620 PSI
   Certified by: AIR LIQUIDE Date: 04-19-04
2. # 487905 Concentration: 4.90 % CO Cyl. Press.: 1630 PSI
   Certified by: AIR LIQUIDE Date: 11-1-07
3. # CA06641 Concentration: 8.63 % CO Cyl. Press.: 1540 PSI
   Certified by: AIR LIQUIDE Date: 1-5-2007
4. # CC-12731 Concentration: 1.98 % CO Cyl. Press.: 1110 PSI
   Certified by: AIR LIQUIDE Date: 03-13-03

Analyzer: **Calibrated Range:** 0-10.0 % **Output:** 0-1.0 V.
Flow: 1.5 SCFH **Measured by:** Rotameter

Calibration Results

Point #	CYL. #	% CO	EXPECTED METER	EXPECTED DVM	ACTUAL METER	ACTUAL DVM	ADJ. METER	ADJ. DVM
1	1	0.00	00.0	.000	00.0	.000	00.0	.000
2	2	4.90	49.0	.490	48.3	.483	49.0	.490
3	3	8.63	86.3	.863	86.4	.864		
4	4	1.98	19.8	.198	19.5	.195		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 5.002

CO Linear Regression Results:

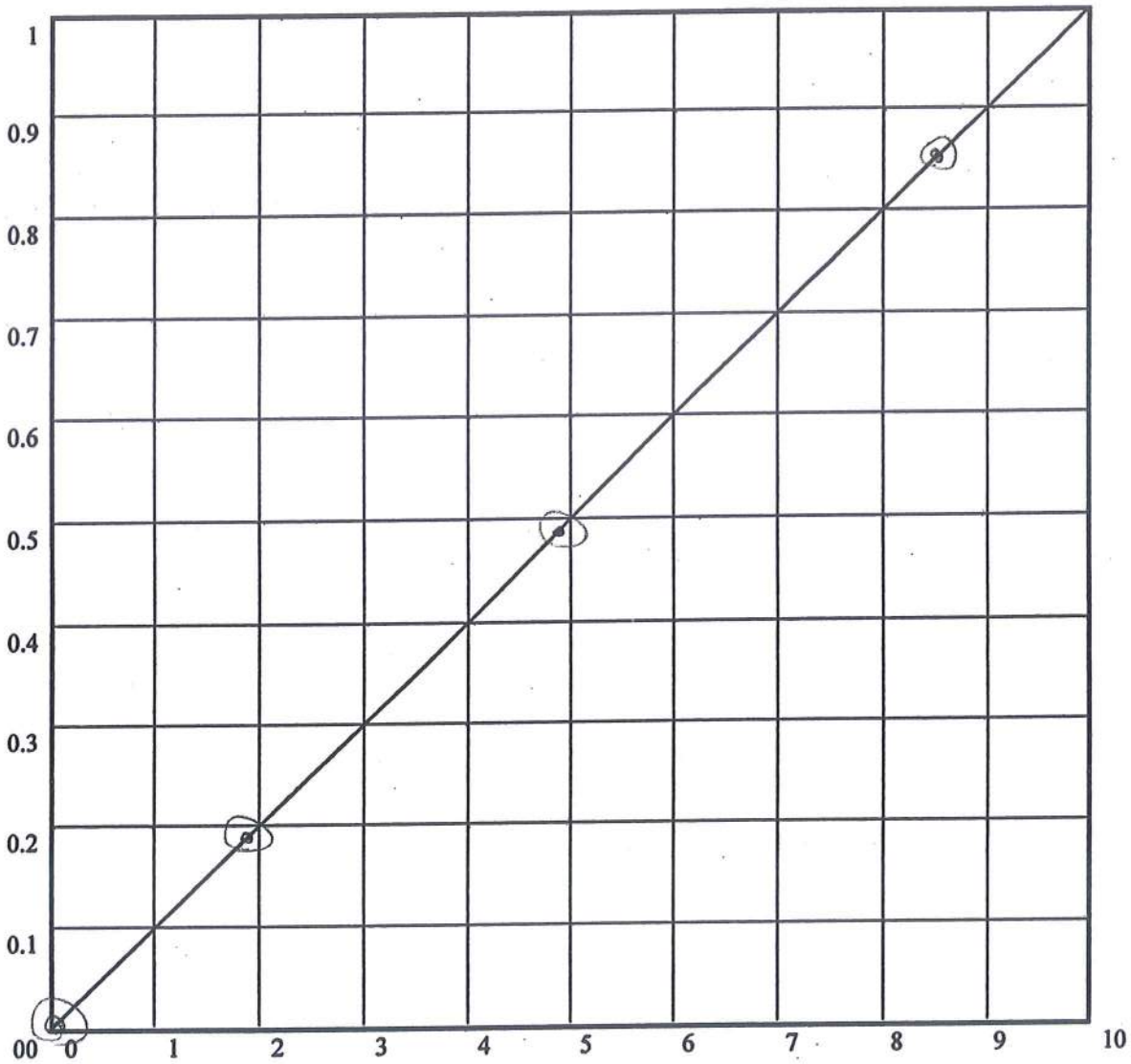
Y = MX +B

Slope (M) = -.0014582

Y Intercept (B) = .1002471

Correlation Coefficient (r) = .9999924

r^2 = .9999849

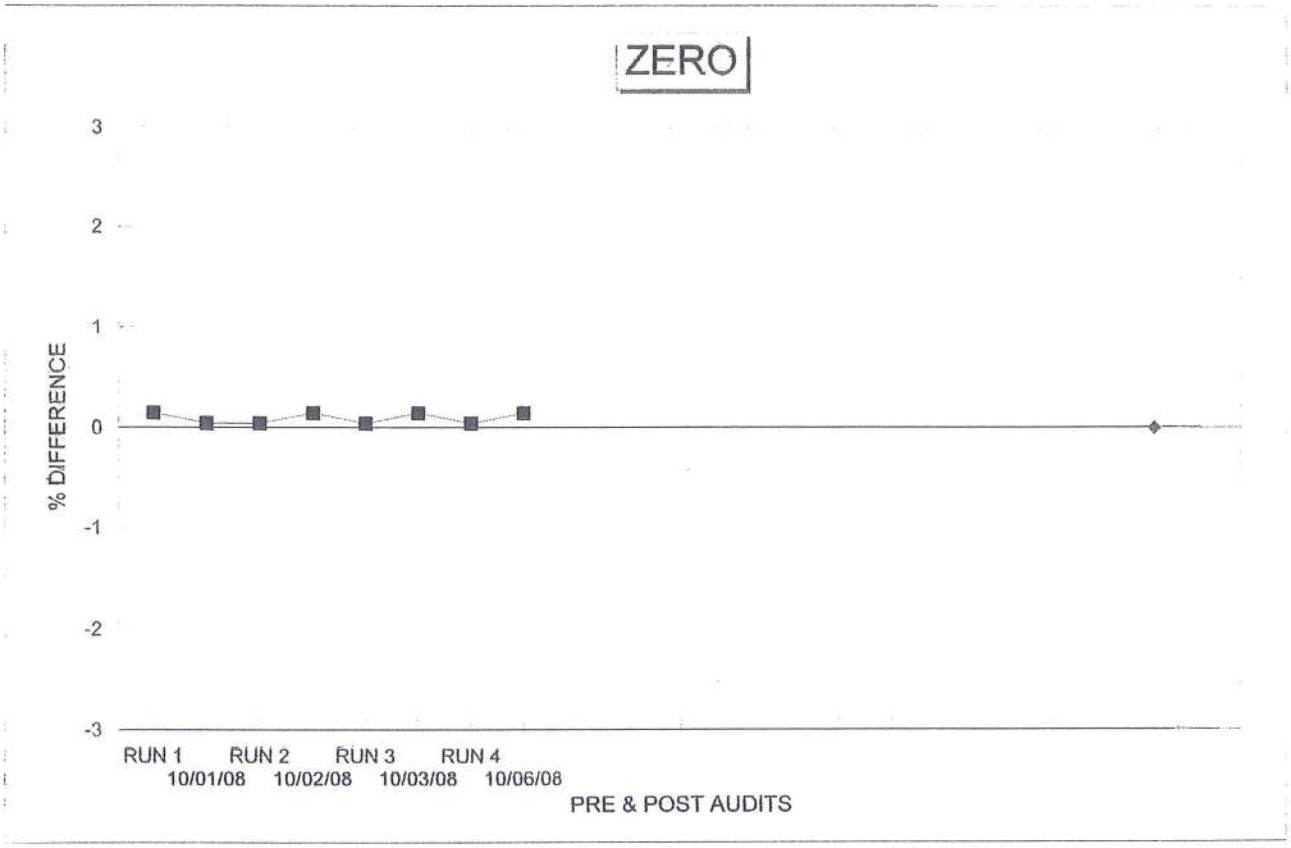


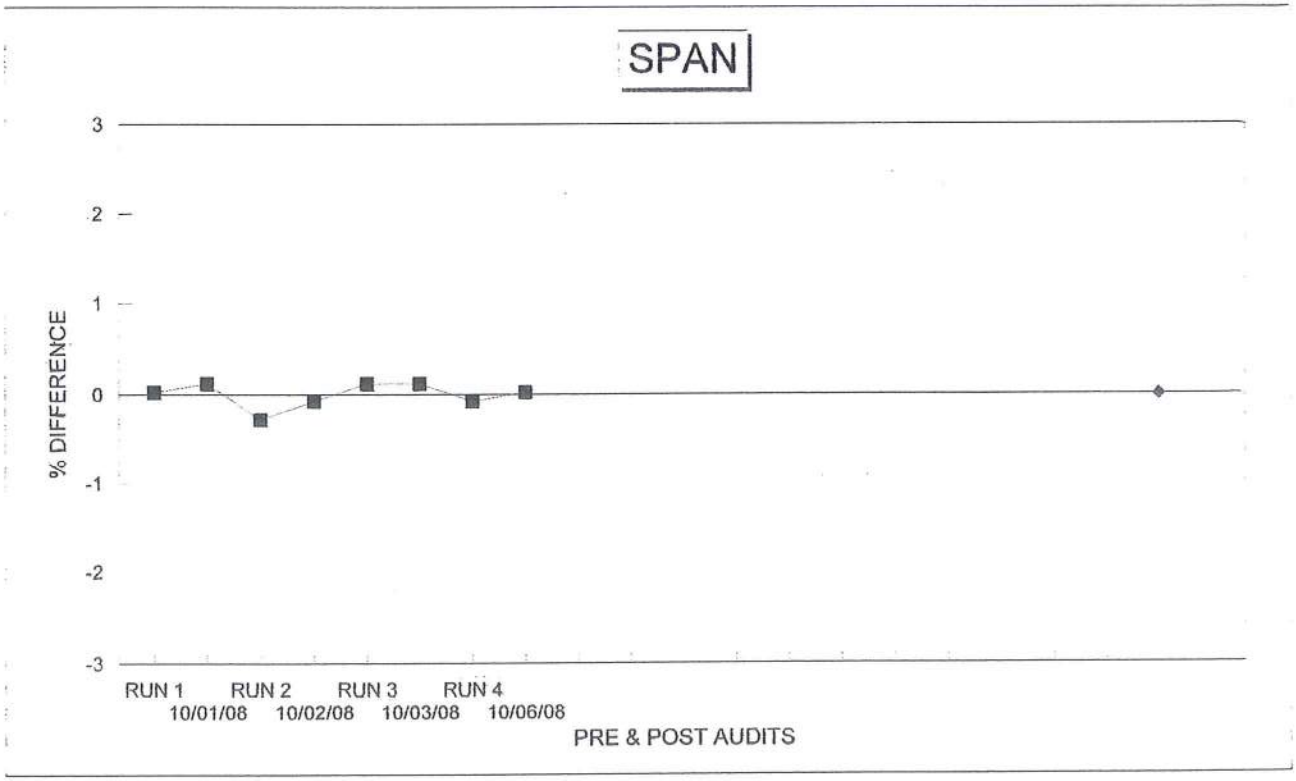
EPA Span Value = ± 2.0% of 10% CO = ± .2%

Cal Volts = Cal Volt Conc - Std Conc = ± Conc Diff = ± Δ %

HIGH VOLTS .864 = 8.64 - 8.63 = .010 = .100

LOW VOLTS .195 = 1.95 - 1.98 = -.030 = -.300


ZERO
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1
10/01/08
RUN 2
10/02/08
RUN 3
10/03/08
RUN 4
10/06/08
PRE & POST AUDITS


SPAN
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1
10/01/08
RUN 2
10/02/08
RUN 3
10/03/08
RUN 4
10/06/08
PRE & POST AUDITS

SO_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 10-1-2008

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

Calibration by: [illegible]

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 30.03 Instrument ID: PRINCO

Temp: 73 Instrument ID: TR

Cylinders:

1. # 168TAC 3A Concentration: 00.00 % SO_2 Cyl. Press.: 620 PSI
   Certified by: AIR LIQUIDE Date: 04-19-04
2. # CC82089 Concentration: 1250 % SO_2 Cyl. Press.: 1850 PSI
   Certified by: AIR LIQUIDE Date: 1-3-2007
3. # ALMO 49127 Concentration: 1770 % SO_2 Cyl. Press.: 760 PSI
   Certified by: SCOTT SPECIALTY GASES Date: 05-15-97
4. # ALMO 52285 Concentration: 506 % SO_2 Cyl. Press.: 710 PSI
   Certified by: SCOTT SPECIALTY GASES Date: 05-15-97

Analyzer: **Calibrated Range:** 0-2500 PPM **Output:** 0-1.0 V.
Flow: 1.5 SCFH **Measured by:** Rotameter

Calibration Results

Point #	CYL. #	PPM SO2	EXPECTED METER	EXPECTED DVM	ACTUAL METER	ACTUAL DVM	ADJ. METER	ADJ. DVM
1	1	0.00	00.0	.000	00.0	.000	00.0	.000
2	2	1250	50.0	.500	50.0	.500	50.0	.500
3	3	1770	70.8	.708	70.9	.709		
4	4	506	20.2	.202	19.9	.199		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 1250.406

SO_2 Linear Regression Results:

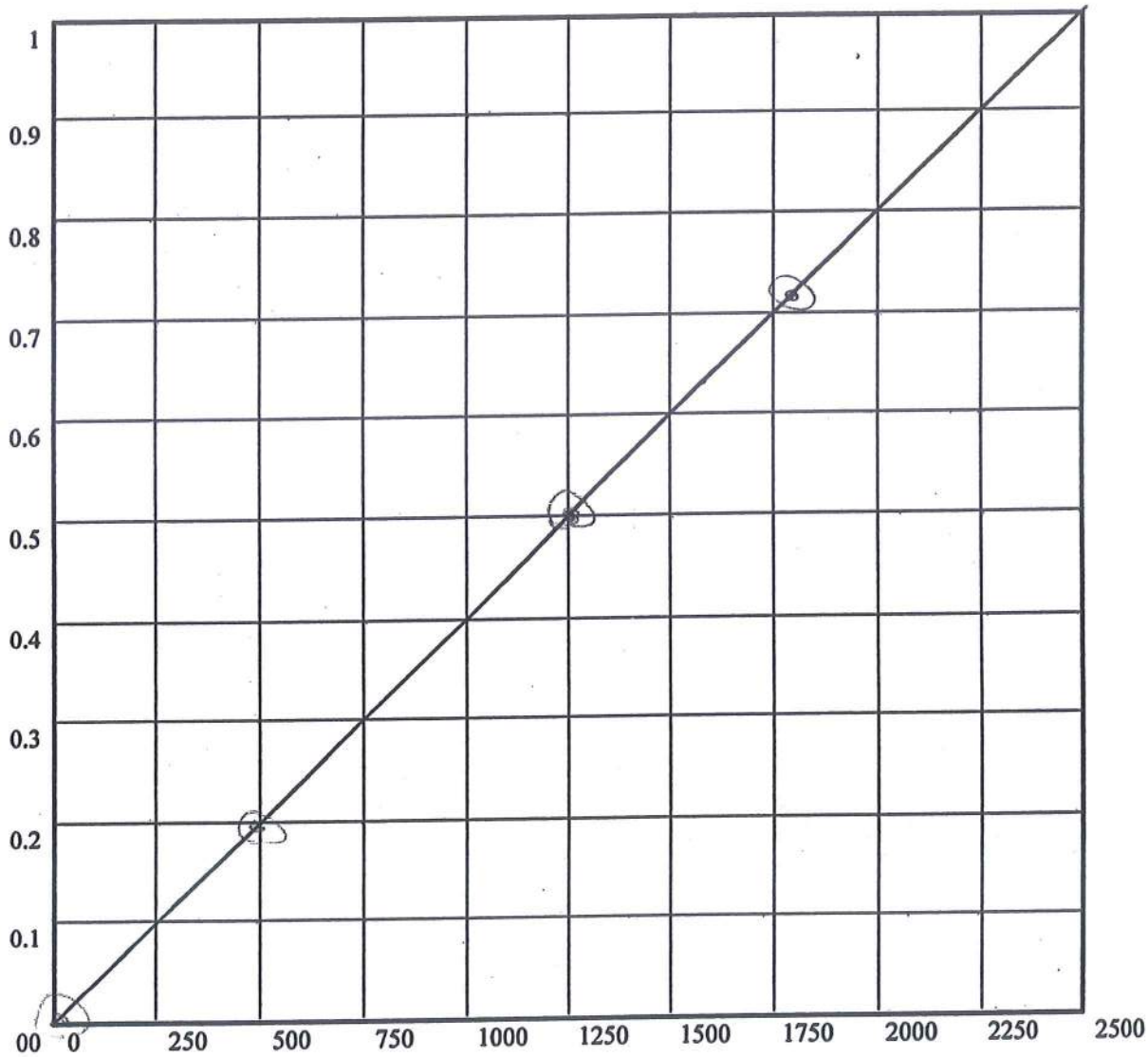
Y = MX +B

Slope (M) = -.0016355

Y Intercept (B) = .0004012

Correlation Coefficient(r) = .9999855

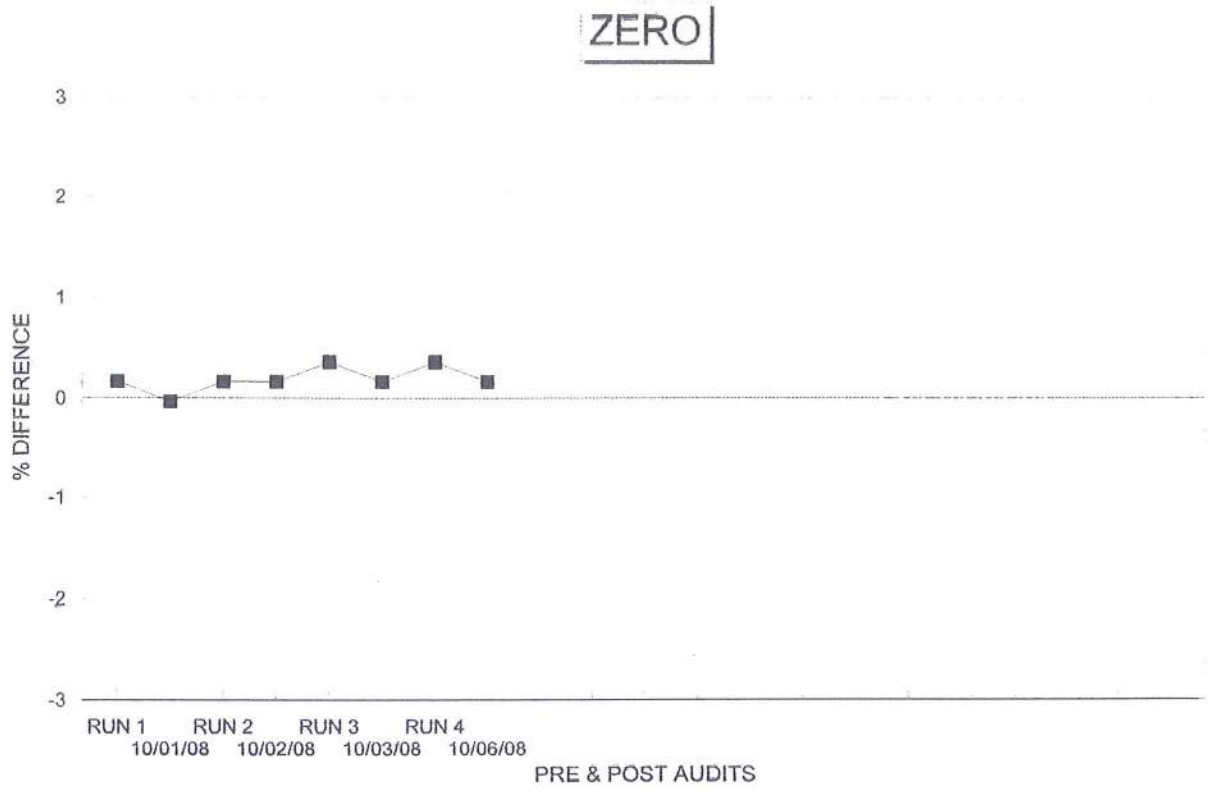
r^2 = .9999711

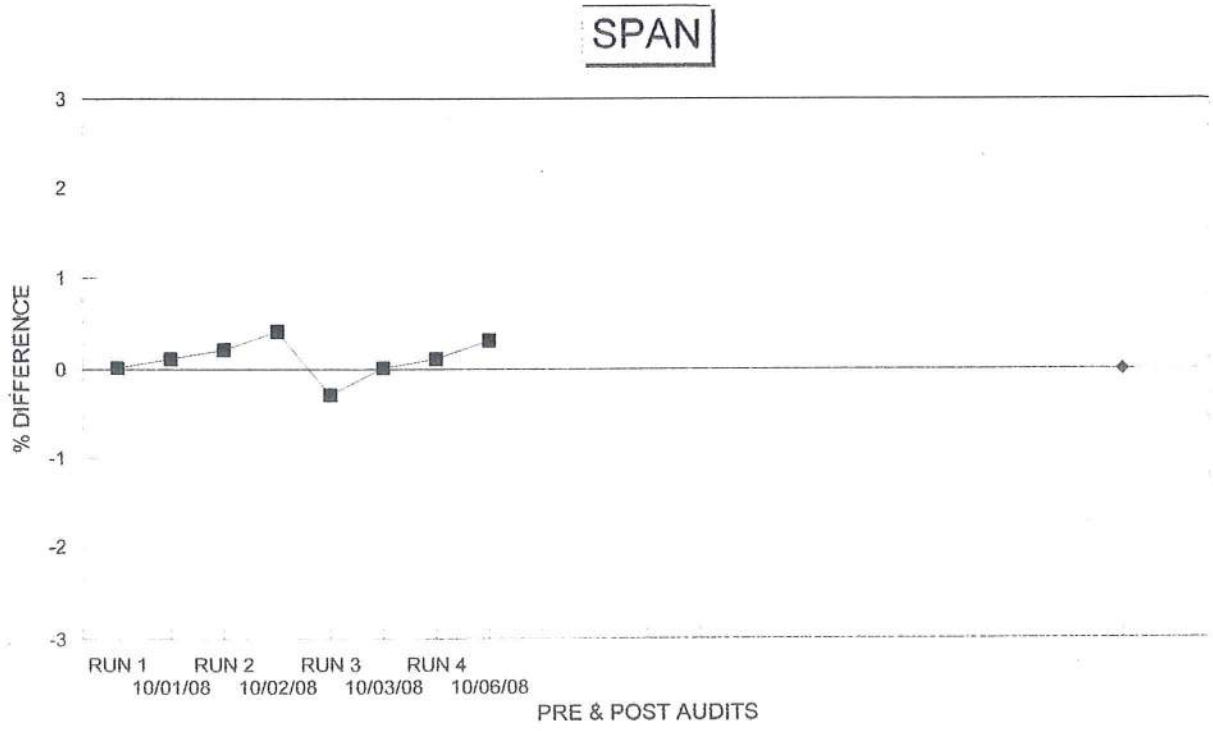


EPA Span Value = ± 2.0% of 2500 PPM SO_2 = ± 50 PPM

Cal Volts = Cal Volt Conc - Std Conc = ± Conc Diff = ± Δ %

HIGH VOLTS	.709	=	1772.5	- 1770.0	= 2.500	=	.100
LOW VOLTS	.199	=	497.5	- 506.0	= -8.500	=	-.340


ZERO
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1
10/01/08
RUN 2
10/02/08
RUN 3
10/03/08
RUN 4
10/06/08
PRE & POST AUDITS


SPAN
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1
10/01/08
RUN 2
10/02/08
RUN 3
10/03/08
RUN 4
10/06/08
PRE & POST AUDITS

LOW SPAN

AIR LIQUIDE

GASES FOR RESEARCH AND DEVELOPMENT

CYL # CC-12731 CGA 590

PRES 1665 VOL 130c.f

TEST # 07203 DATE 03-13-03

Analytical Method GC/paramagnetic

	Requested	Analyzed
Hydrogen		
Nitrogen	Bal.	Bal.
Argon		
Air		
Carbon Monoxide	2%	1.98%
Methane		
Oxygen	6.25%	6.25%
Helium		
Carbon Dioxide	6.25%	6.22%

SIGNED

AIR LIQUIDE

1451 THORNE RD.
TACOMA, WA 98421
TEL: (253) 383-3637

THE ONLY LIABILITY OF THIS COMPANY FOR GAS WHICH FAILS TO COMPLY WITH THE ANALYSIS SHALL BE REPLACEMENT THEREOF BY THE COMPANY WITHOUT EXTRA COST.

DO NOT REMOVE THIS TAG

AIR LIQUIDE™

CERTIFICATE OF ANALYSIS

Customer : Pacifice Rim Oxygen Service
.O. Number : 200159
Document # : 23639406-1A
lix/Lot # : SFS103795
Item Number : SFS103795
/alid Until : 4 January, 2012

Specification : CUSTOM CERTIFIED
Phase : GAS
Cyl. Size : 30AL
Valve : CGA 590
Pressure : 1667
Volume : 120 SCF

ylinder Number: **CAO6641**

Component	Requested Concentrations MOLE	Actual Concentration MOLE	% Analytical Uncertainty	Equipment Used		
				Scale	Analyt. Inst.	Calibration Standard
NITROGEN	Balance	Balance		2		
CARBON MONOXIDE	8.6 %	8.63 %		2	4620	PQ
OXYGEN	21 %	20.9 %		2	4620	TB
CARBON DIOXIDE	21 %	21.1 %		2	4620	PD
7001-30AL						

This mixture was certified by analysis using one or more calibration standards prepared with scales certified against weights traceable to N.I.S.T.

Comments:

Dewpoint calculated to 40° F, unless otherwise stated. Improper storage or use may affect the accuracy of this standard.
Reported impurities are approximate and should not be used for calibration purposes.

Prepared by _____ Date: 5-Jan-2007

8832 Dice Road -- Santa Fe Springs, CA 90670
Phone (562) 945-1383 **Fax** (562) 696-7903
ISO: 9001-2000

A-L WELDING PRODUCTS

A Division of Pacific Rim Oxygen Services, Inc.
15700 Nelson Road South • Tukwila, Washington 98188
Telephone (425) 228-2218 • Fax (425) 228-2397

Certificate of Analysis

Customer: AL Welding Products
Product: 5% CO, 12.5% CO2, 12.5% O2, balance Nitrogen
Grade: Certified Standard
Cylinder Number: 487905
Product Code: 2505COOXCDNTHC
Lot Number: K3171302

11-01-07

CGA 590
Pressure: 1650 psig
Contents: 175 ft^3

Mixture Analysis

Component	Specification	Concentration	Analytical Method
Oxygen	12.5%	12.6%	MTIGC-TCD
CO2	12.5%	12.2%	Varian
CO	5.0%	4.9%	MTIGC-TCD
Nitrogen	Balance	Balance	MTI GC-TCD

I certify the above referenced cylinder was analyzed and found to contain the listed concentrations.

Thomas M Chesser
Thomas M Chesser, Chemist

11-01-07
Date

Scott Specialty Gases

500 WEAVER PARK RD,LONGMONT,CO 80501 Phone: 303-442-4700 Fax: 303-772-7673

CERTIFICATE OF ANALYSIS: Interference-Free™ Multi-Component EPA Protocol Gas

Customer
ENERGY & ENV MEASUREMENT

C/O ED WADINGTON
3730 N. PELLEGRINO DR.
TUCSON,AZ 85749

Assay Laboratory

SCOTT SPECIALTY GASES
500 WEAVER PARK RD
LONGMONT,CO 80501

Project No.: 08-34135-001
P.O. No.: VERBAL

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure #G1; September, 1993.

Cylinder Number: ALM052285 Certification Date: 4/21/97 Exp. Date: 4/21/2000
Cylinder Pressure***: 1996 PSIG

COMPONENT	CERTIFIED CONCENTRATION		ANALYTICAL ACCURACY**
SULFUR DIOXIDE *	506	PPM	+/- 1% NIST Traceable
NITROGEN	--	BALANCE	

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is inclusive of usual known error sources which at least include precision of the measurement processes.
* Product certified as +/- 1% analytical accuracy is directly traceable to NIST standards.
* This Protocol has been certified using corrected NIST SO2 standard values, per EPA guidance dated 7/24/96 and will not correlate with uncorrected Protocols.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1661	9/27/98	ALM059505	488.5 PPM	SO2/N2

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	LAST DATE CALIBRATED	ANALYTICAL PRINCIPLE
FTIR System/8220/AAB9400251	03/20/97	Scott Enhanced FTIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

SULFUR DIOXIDE *

First Triad Analysis

Date: 04/14/97	Response Unit: PPM	
Z1 = 0.3847	R1 = 487.72	T1 = 505.77
R2 = 488.79	Z2 = 1.6201	T2 = 505.69
Z3 = 1.6425	T3 = 505.78	R3 = 488.95
Avg. Concentration:	505.6	PPM

Second Triad Analysis

Date: 04/21/97	Response Unit: PPM	
Z1 = 0.3241	R1 = 488.29	T1 = 505.43
R2 = 488.83	Z2 = 1.6098	T2 = 505.75
Z3 = 0.8340	T3 = 505.74	R3 = 488.69
Avg. Concentration:	505.6	PPM

Calibration Curve

Concentration = A + Bx + Cx2 + Dx3 + Ex4
r = 0.999990
Constants:
A = 0.000000
B = 1.000000
C = 0.000000
D = 0.000000
E = 0.000000

Special Notes:

ANALYST: Devon VonFeldt
Devon VonFeldt

SO2 concentration analysis
05/10/07

Vm(std)	1.500			
mcf	1.004		dscf=	1.500
Hg	30.01			
DH	0.12			
temp	68	528	ppm =	498
ml BA ++	174			
Normality	0.0101		Run1	498
			Run 2	518
			Run3	498
Tank I.D. #	ALMO52285			
			avg.	505

AIR LIQUIDE™

CERTIFICATE OF ANALYSIS

Customer : Pacific Rim Oxygen Service Inc
P.O. Number : 200160
Document # : 23540983-1A
Mix/Lot # : SFS103340
Item Number : SFS103340
Valid Until : 2 January, 2010

Specification : CUSTOM CERTIFIED
Phase : GAS
Cyl. Size : 30AL
Valve : CGA 660
Pressure : 2000
Volume : 144 SCF

Cylinder Number: **CC82089**

Component	Requested Concentrations MOLE	Actual Concentration MOLE	% Analytical Uncertainty	Equipment Used: Scale	Analyt. Inst.	Calibration Standard
NITROGEN	Balance	Balance		4		
SULFUR DIOXIDE	1250 PPM	1250 PPM	+/- 2%	4	4503	GL
6154-30AL						

This mixture was certified by analysis using one or more calibration standards prepared with scales certified against weights traceable to N.I.S.T.

Comments:

Dewpoint calculated to 40° F, unless otherwise stated. Improper storage or use may affect the accuracy of this standard.
Reported impurities are approximate and should not be used for calibration purposes.

Prepared by _____ Date: 3-Jan-2007

8832 Dice Road -- Santa Fe Springs, CA 90670
Phone (562) 945-1383 **Fax** (562) 696-7903
ISO: 9001-2000

Scott Specialty Gases

500 WEAVER PARK RD,LONGMONT,CO 80501 Phone: 303-442-4700 Fax: 303-772-7673

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
ENERGY & ENV MEASUREMENT

C/O ED WADINGTON
3730 N. PELLEGRINO DR.
TUCSON,AZ 85749

Assay Laboratory

SCOTT SPECIALTY GASES
500 WEAVER PARK RD
LONGMONT,CO 80501

Project No.: 08-34135-003
P.O. No.: VERBAL

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure #G1; September, 1993.

Cylinder Number: ALM049127 Certification Date: 4/21/97 Exp. Date: 4/21/2000
Cylinder Pressure***: 1860 PSIG

COMPONENT	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY**
SULFUR DIOXIDE *	1,770 PPM	+/- 1% NIST TRACEABLE
NITROGEN	BALANCE	

*** Do not use when cylinder pressure is below 150 psig.

** Analytical accuracy is inclusive of usual known error sources which at least include precision of the measurement processes. Product certified as +/- 1% analytical accuracy is directly traceable to NIST standards.

* This Protocol has been certified using corrected NIST SO2 standard values, per EPA guidance dated 7/24/96 and will not correlate with uncorrected Protocols.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM-R-1696	7/03/98	ALM057797	3131. PPM	SULFUR DIOXIDE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	LAST DATE CALIBRATED	ANALYTICAL PRINCIPLE
FTIR System/8220/AAB9400251	03/20/97	Scott Enhanced FTIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

SULFUR DIOXIDE *

First Triad Analysis

Date: 04/14/97	Response Unit: PPM	
Z1 = 0.7210	R1 = 3127.7	T1 = 1767.1
R2 = 3131.7	Z2 = 4.6770	T2 = 1768.1
Z3 = 4.6770	T3 = 1768.1	R3 = 3133.7
Avg. Concentration:	1768.	PPM

Second Triad Analysis

Date: 04/21/97	Response Unit: PPM	
Z1 = 0.4020	R1 = 3125.8	T1 = 1770.2
R2 = 3132.3	Z2 = 6.6540	T2 = 1769.3
Z3 = 4.9410	T3 = 1770.9	R3 = 3134.9
Avg. Concentration:	1770.	PPM

Calibration Curve

Concentration = A + Bx + Cx2 + Dx3 + Ex4	
r = 0.999990	1696
Constants:	A = 0.00000
B = 1.00000	C = 0.00000
D = 0.00000	E = 0.00000

Special Notes:

ANALYST: Devon VonFeldt
DEVON VONFELDT

SO2 concentration analysis
05/10/07

Vm(std)	1.500			
mcf	1.004		dscf=	1.500
Hg	30.11			
DH	0.12			
temp	68	528	ppm =	1778
ml BA ++	621			
Normality	0.0101		Run1	1758
			Run 2	1770
			Run3	1778
Tank I.D. #	ALMO49127			
			avg.	1769

Certificate of Analysis

ANALYTICAL CONTROL LABORATORY ANALYSIS
METHYLENE CHLORIDE - OPTIMA

Catalog No. D151
Lot No. 035941

July 23, 2003

This is to certify that this lot was tested and found to comply with the specifications for this product. The following are the actual analytical results obtained:

TESTS		ACTUAL ANALYSIS
Assay		99.9%
Color		5 APHA
Description		Clear, Colorless Liquid
Free Halogens		Pass Test
Identification		Pass Test
Fluorescence Background (as Quinine Sulfate)		Not more than 1 ppb
Certified for EPA Test #1625		Pass Test
Pesticide Residue Analysis (as Heptachlor Epoxide)		Not more than 10ng/l
Density (g/ml) at 25°C		1.317
Optical Absorbance	At 254 nm	0.002
	At 240 nm	0.10
	At 233 nm	0.54
Refractive Index at 25°C		1.4209
Residue after Evaporation		0.4 ppm
Titratable Acid		0.00004 Meq/g.
Preservative (Amylene)		64 ppm
Water (H_2O)		0.008%

Fisher Scientific
Chemical Division
1 Reagent Lane
Fair Lawn, N.J. 07410
201-796-7100

Approved By: Edgar E. Hess

Edgar E Hess
Q.C. Laboratory Manager

Certificate of Analysis

ANALYTICAL CONTROL LABORATORY ANALYSIS
METHYLENE CHLORIDE - OPTIMA

Catalog No. D151
Lot No. 035941

July 23, 2003

This is to certify that this lot was tested and found to comply with the specifications for this product. The following are the actual analytical results obtained:

TESTS		ACTUAL ANALYSIS
Assay		99.9%
Color		5 APHA
Description		Clear, Colorless Liquid
Free Halogens		Pass Test
Identification		Pass Test
Fluorescence Background (as Quinine Sulfate)		Not more than 1 ppb
Certified for EPA Test #1625		Pass Test
Pesticide Residue Analysis (as Heptachlor Epoxide)		Not more than 10ng/l
Density (g/ml) at 25°C		1.317
Optical Absorbance	At 254 nm	0.002
	At 240 nm	0.10
	At 233 nm	0.54
Refractive Index at 25°C		1.4209
Residue after Evaporation		0.4 ppm
Titratable Acid		0.00004 Meq/g.
Preservative (Amylene)		64 ppm
Water (H_2O)		0.008%

Fisher Scientific

Chemical Division
1 Reagent Lane
Fair Lawn, N.J. 07410
201-796-7100

Approved By: Edgar E. Hess

Edgar E Hess
Q.C. Laboratory Manager

KEITHLEY

Keithley Instruments, Inc.
28775 Aurora Road
Cleveland, Ohio 44139
(440) 248-0400
Telefax: (440) 248-6168

Certificate of Calibration

Model 2700 **Serial No** 0872585 **Date** 13 Mar 2002

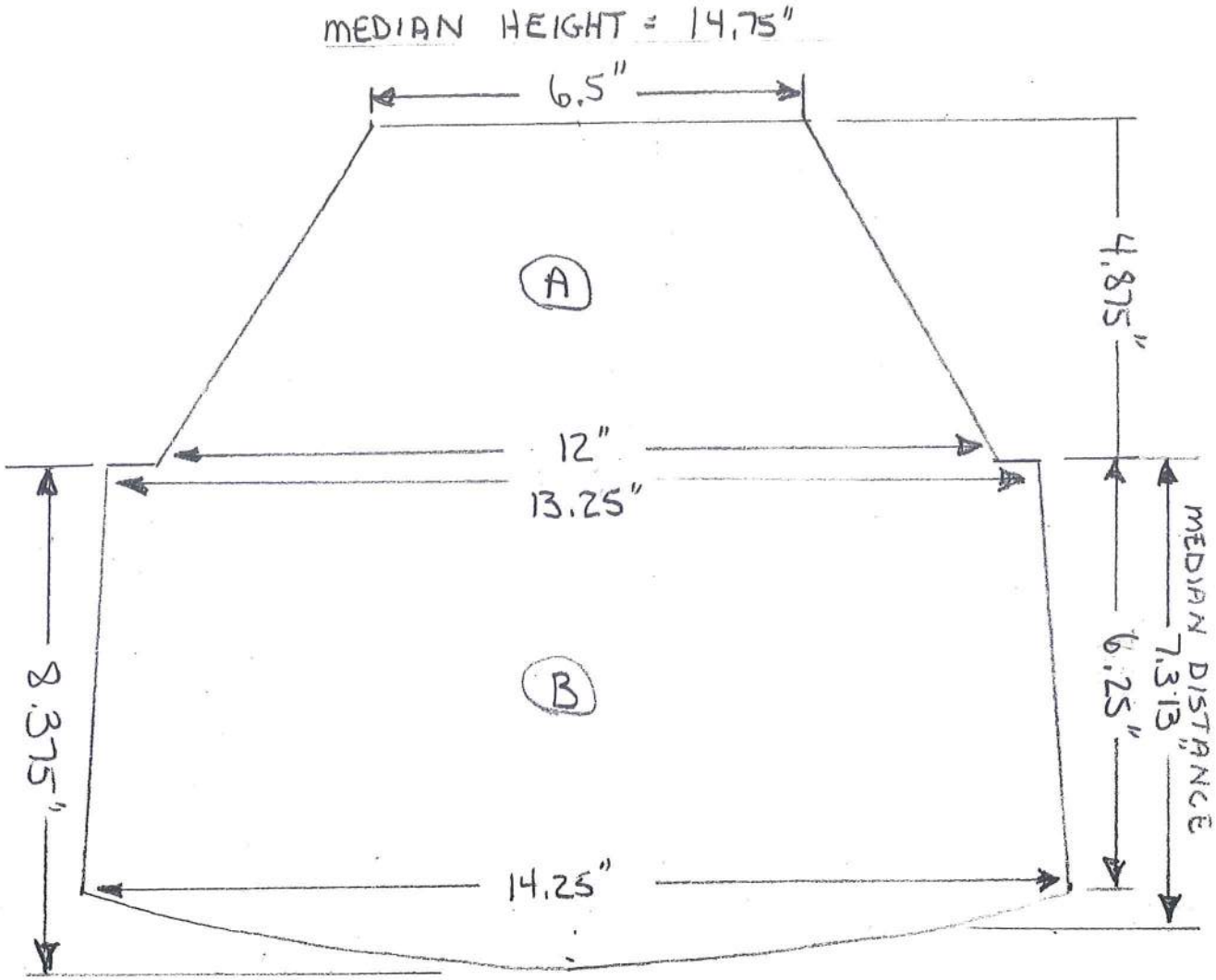
This notification serves to certify that the unit described above has been inspected and tested in accordance with specifications published by Keithley Instruments, Inc.

The accuracy and calibration of this instrument are traceable through reference standards that are compared, at planned intervals, to national standards maintained by the National Institute of Standards and Technology (NIST), by comparison to natural physical constants or self-calibrating ratio type measurements.

The measurement standards which support this calibration are calibrated on a schedule to maintain required accuracy level.

James A. Crane
Metrology Services

FIREBOX VOLUME AND FUEL LOAD CALCULATIONS
For The Jotul F370 NON-CATALYTIC



$A = \left(\frac{6.5+12}{2}\right) \times 4.875 \times 14.875'' = 670.770$

$B = \left(\frac{13.25+14.25}{2}\right) \times 7.313 \times 14.875'' = 1495.737$

2166.507

1.254

FUEL LOAD RANGE

Low	Ideal	High
7.899	8.776	9.654

Cat.no 138964
December 2008

This appliance must be installed in conformance with local and national building regulations.
It is important that the these instructions be carefully read and understood before beginning the installation. Jøtul pursues a policy of continual product development. Consequently, products may differ in specification, color or type of accessories from those illustrated or described in various publications.

Jøtul vise sans cesse a ameliorer ses produits. C'est pourquoi, il se reserve le droit de modifier les specifications, couleurs et equipement sans avis prelable.

Jøtul North America, Inc.
55 Hutcherson Dr.
Gorham, Maine 04038
USA

Jøtul AS
P.O. Box 1411
N-1602 Fredrikstad,
Norway

JØTUL

September 23, 2008

Mr. Chip Wadington
Lokee Testing Laboratory
13235 Prairie Circle East
Sumner, Washington 98390

Dear Mr. Wadington,

The following is a guideline for adjusting the air control of the Jøtul F370 in order to achieve burn rates in the appropriate categories.

The primary air is operated by a slide type control located top center of the stove above the door.

The secondary air is controlled through a an opening located at the center rear bottom of the stove. Secondary air is a non-adjustable fixed opening size.

Air Control Setting

Burn Rate	Primary Air
Low (Min. dry kg/hr)	1/8" open
Med. Low (< 1.25 dry kg/hr)	3/32" open
Med. High (1.25-1.90 dry kg/hr)	7/16" open
High (Max dry kg/hr)	Max. open

Air setting information contained in the operation manual will be presented in a way as to be representative of the information contained above.

Sincerely,

Roger W. Purinton
Product Development Manager
Jotul North America
55 Hutcherson Drive
Gorham, Maine 04038

Jøtul F 370
Woodburning Stove

Jøtul F 370
Woodburning Stove

Installation and Operating Instructions
for the United States & Canada

JØTUL

Keep these instructions for future reference.

Operation

Read the following section carefully before building a fire in your stove.

Fuel

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. **Frequent use of green or inadequately seasoned wood is conducive to creosote accumulation and generally poor performance.**

DO NOT BURN...

- Coal
- Garbage
- Cardboard
- Solvents
- Treated or painted wood
- Chemical Chimney cleaners
- Colored paper
- 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.**

WARNING

NEVER 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.

OPERATE THIS STOVE ONLY WITH THE DOOR FULLY CLOSED. OPERATION WITH A PARTIALLY OPENED DOOR MAY RESULT IN OVER-FIRING. ALSO, IF THE DOOR IS LEFT PARTLY OPEN, GAS AND FLAME MAY BE DRAWN OUT OF THE STOVE OPENING, CREATING RISKS FROM BOTH FIRE AND SMOKE.

Air Control Settings

A single lever regulates the Primary Air flow that controls the intensity of the fire and consequent heat output and burn time. The lever is located within the slot above the stove door.

When first starting or reviving the fire, the control lever should be set at the far right position to allow the maximum amount of air into the stove. See fig.15. After the fire is well-established, the lever should be set at position to moderate incoming air to maintain the desired long term heat output and/or burn time.

In general, the more air made available to the fuel will result in the hottest fire intensity and the fastest fuel consumption. Alternatively, the less air made available to the firebox will result in low heat output and slower fuel consumption.

Use the following guide for best performance.

Burn Rate	Air Control Setting
Low	Fully Closed
Med. Low	3/32"Open
Med. High	7/16"Open
High	Max. Open

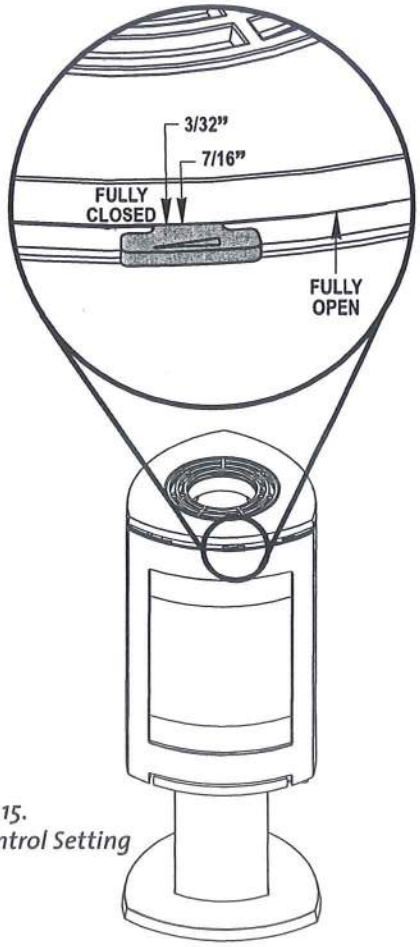


Figure 15.
Air Control Setting

Starting and Maintaining a Fire

Burn only solid wood directly on the bottom plate of the stove. Do not elevate the fire in any way.

1. Set the Air Control Lever in the full open position. Crumple several sheets of newspaper directly on the bottom plate..
2. Place several pieces of small dry kindling (approx. 1" in diameter) on top of the newspaper, with two to three small logs (approx. 2" to 3" in diameter) on top.
3. Light the fire and close the door. Gradually build the fire by adding larger and larger logs as the fire develops a bed of coals.
4. When you have added the final logs, adjust the Air Control Lever to provide the desired fire intensity.

Experiment with a variety of air control settings to determine the best one for your individual circumstances. Remember that fuel characteristics, chimney system condition, building design, and weather conditions all affect the performance of your fireplace insert. In time, you will discover how these elements combine and how you can work with them to achieve satisfactory performance.

Break-in Period

The cast iron parts of your stove require a break-in process to allow them to gradually adjust to thermal expansion and contraction. This is accomplished by building a series of three or four fires, each somewhat hotter than the last. Allow the stove to cool completely before building the next fire.

Limit the first fire to just kindling and a couple of 1 -2 inch logs and add progressively more and larger logs to subsequent fires, keeping the Air Control set to the fully open position.

It is normal for a new stove to emit odor and possibly smoke during the first few fires. This is characteristic of the burn-off of residues from the manufacturing process and the curing of painted surfaces. Open a window near the stove to provide plenty of fresh air to the room during this "seasoning" period.

WARNING!
NEVER OVER-FIRE THE STOVE. IF ANY PART OF THE STOVE OR CHIMNEY GLOWS, YOU ARE OVER-FIRING. A HOUSE FIRE OR SERIOUS DAMAGE TO THE STOVE OR CHIMNEY COULD RESULT. IF THIS CONDITION OCCURS, IMMEDIATELY CLOSE THE AIR CONTROL.

Adding Fuel to the Fire

When reloading the stove while a bed of hot embers still exists, follow this reloading procedure:

- Always wear stove gloves when tending to the fire.
- Push the Air Control Lever to the full open position (far right).
- ***Always wait a few seconds before opening the door.*** This allows the renewed air circulation to clear unburned gases from the firebox.
- 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 and secure the latch.
- Wait 5 – 10 minutes for the fire to reestablish before adjusting the Air Control Lever for the desired heat output. If a thick bed of live coals is present, you may be able to add fuel and immediately set the air control without waiting for the fire to be reestablished.

Creosote Formation

This appliance is designed to burn wood cleanly and efficiently when operated as described in this manual. However, when wood is burned slowly and at low temperatures, tar and other organic vapors are produced which condense on the relatively cooler chimney flue surfaces to form creosote. Failure to keep the chimney system free of creosote build up could result in a chimney fire.

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 flue and connector pipe cleaned and inspected at the beginning of the heating season and then inspected twice per month during frequent use. Clean the chimney whenever creosote accumulation of 1/4" or more is evident. 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. An exterior chimney, whether masonry or prefabricated steel, will be exposed to cold outside temperatures, and consequently, will be more prone to creosote accumulation than an interior flue.

A chimney flue located within the home interior will benefit from the insulating characteristics of the building itself. Consequently, the flue system will be less conducive to condensation of unburned

gases and minimal creosote accumulation will result.

As a general rule, try to avoid burning the stove at the lowest air control settings. Although a low setting will prolong burn time, it may also result in incomplete combustion. In reducing the fire intensity, draft is weakened and the chimney flue cools. This, together with the increase in unburned gases, can lead to rapid creosote accumulation.

Maintenance

Ash Removal

Always wear stove gloves when handling ashes.

Ash removal will be required periodically depending on how frequently the stove is used. Use a steel ash shovel and metal container with a tight-fitting lid. **NEVER USE A PAPER OR PLASTIC BAG AS AN ASH RECEPTACLE.**

The container of ashes 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 dispersed, **they should be kept in the closed container until all coals and cinders have thoroughly cooled.**

Glass Care

Cleaning

Occasionally it will be necessary to clean the carbon deposits and fly ash off of the glass. If deposits are allowed to remain on the glass for an extended period of time, the glass may become etched and cloudy.

Creosote deposits should burn off during the next hot fire.

1. The glass must be COMPLETELY COOL.
2. Only use a cleaner that is specifically designed for this purpose. DO NOT USE ABRASIVE CLEANING AGENTS. The use of abrasives will damage the glass, leaving a frosted surface. Crumpled newspaper is an especially good cleaning material.
3. Rinse and dry glass completely before lighting a fire.

Glass Replacement

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 the replacement procedure below.

IMPORTANT:

NEVER OPERATE THE STOVE WITH A CRACKED OR BROKEN GLASS PANEL. Replace glass only with part # 221648 specifically designed for the Jøtul F 370. Do not use substitutes. Replacement glass can be ordered from your Jøtul dealer.

1. Remove the door from the stove and place on a flat surface.
2. First loosen and then carefully remove all of the glass clips from the inside of the door. See fig. 19.
3. 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 loosely reinstall the glass clips. Tighten the clips, alternating at opposite corners. Avoid applying uneven pressure on the glass.
7. It may be necessary to retighten the glass clips after the stove has burned and the gasketing has seated.

EXAMPLE CALIBRATION/DATA FLOW

All individual test run raw data sheets are organized in a manner that would allow a data reviewer to follow the data as it is being calculated in a step by step fashion. In many cases, the equations used to calculate a specific required data are given on the raw data sheets themselves.

For example, the particulate emission rate in g/dscf is calculated on Data Sheet #7. However, the data used to derive this data begins on Data Sheet #2 (Meterbox Data Sheet) where the meter volume (cubic feet), average meter temperature (°F), average ΔH (in. H_2O), and average Barometric pressure (in. Hg) are recorded and averaged. Each of the averages for these parameters are used in equation 1 on P. 7 where the volume (MCF) is converted to dscf.

The moisture catch total (g. H_2O) on the Particulate Catch/Moisture Data sheet (p. 3) is transferred to P. 7 and the percent stack moisture is calculated in equations 2 and 3.

The gross and net gravimetric (g) particulate catches are determined and calculated on PP. 3-6. Pages 4-1, 4-2 and 4-3 show the initial (tare) constant weights for filters (p. 4-1) and beakers (p. 4-2) and the final constant weights (p. 4-3) for those filters and beakers used for each run. Final and tare weight data is transferred to P. 3 and the gross gravimetric (g) catch for each filter and beaker is calculated. On P. 5 the gravimetric catch for each blank is calculated. The gross gravimetric catch for each filter and beaker is transferred to P. 6 and the net gravimetric catch (g) is calculated, as well as front half and back half catch totals. The net gravimetric catch (g) is transferred to P. 7 and the grain loading/dscf is calculated in equation 4.

Some data sheet specific information is listed below on a page by page basis.

P. 8 The % ambient moisture is determined by interpolating from psychrometric charts which are contained in the State of Oregon Department of Environmental Quality's "Standard Method for Measuring the Emissions and Efficiencies of Woodstoves".

The % relative humidity is determined from the wet bulb/dry bulb temperature readings using the tables found in Section 3.1.2.4 of the State of Montana Air Quality Bureau's Quality Assurance Manual.

P. 10 The uncorrected moisture meter readings are corrected for pin insulation and may or may not be corrected for ambient (wood) temperatures. All corrections are based upon the correction equations or tables supplied by the moisture meter manufacturer. (These are standard, known corrections.)

P. 11 The moisture meter readings are corrected as discussed above.

P. 12 The gas concentrations shown for each gas monitored (CO_2, O_2, CO and SO_2) are determined by converting the analyzer's voltage output recorded on P. 12 to the concentration shown using the analyzer's current calibration curve. The SO_2 concentration is determined using the manufacturer's calibration curve and the current calibration curve.

The cal. W/B (calculated wet bulb) temperature is obtained by first determining the % moisture in the extracted flue gas stream using the temperature data from thermocouples 1 (Wet Bulb) and 2 (Dry Bulb). Then based upon the stack temperature (thermocouple 3) and the % moisture in the extracted gas stream, a calculated wet bulb temperature is determined. All data is derived from the psychrometric tables found in the State of Oregon's "Standard Method for Measuring the Emissions and Efficiencies of Woodstoves".

The following pages contain the equations used to generate the data on Tables 3-5 on the computer printouts:

Dry Gas Volume (standard):

$$V_{m(std)} = \frac{V_m * 17.65 * mcf * \left(P_{bar} + \frac{\Delta H}{13.6}\right)}{T_m}$$

Volume of Water:

$$V_{w(std)} = (0.04707)(ml\ H_2O)$$

Moisture Content:

$$B_{ws} = \left(\frac{V_w}{V_w + V_{m(std)}}\right) * 100$$

Dry Burn Rate:

$$Br = \left(\frac{Wwt - (Wwt * \%\ H_2O)}{2.2046}\right) * \frac{60}{\theta}$$

Carbon Balance (N_t):

$$Nt = \frac{K_3 Nc}{(YCO_2 + YCO + YHC)}$$

Stack Flow Rate (Q_{sd}):

$$Q_{sd} = K_4 N_t Br$$

Particulate Concentration (C_s):

$$C_s = \frac{M_n}{V_{m(std)}}$$

Particulate Emission Rate (E):

$$E = C_s Q_{sd}$$

Proportional Rate Variation (Pr):

$$Pr = \left(\frac{\theta S_i * V_{mi(std)}}{10 \sum_{i=1}^{n} [S_i * V_{mi(std)}]} \right) * 100$$

Where:

Br =	dry wood burn rate, kg/hr.
B_{WS} =	Water vapor in the gas stream, proportion by volume.
c_s =	Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).
E =	Particulate Emission Rate, g/hr.
ΔH =	Average pressure differential across the orifice meter (see Figure 5-2), mm H_20 (in. H_20).
K_3 =	1.0 lb/lb (English) 1000 g/kg (metric)
K_4 =	0.02406 dsm^3/g-mole(metric) 384.8 dscf/lb-mole (English)

m_n = Total amount of particulate matter collected, mg.

mcf = Dry gas meter correction factor.

N_c = Gram atoms of carbon/gram of dry fuel (lb/lb), equal to 0.0425.

N_t = Total dry moles of exhaust gas/Kg of dry wood burned.

P_r = Percent of proportional sampling rate.

P_{bar} = Barometric pressure at the sampling site, mm Hg (in. Hg).

Q_{sd} = Total gas flow rate, dscf/hr.

S_i = Concentration measured at the SO_2 analyzer for the "i^{th}" 5 minute interval, ppm.

S_1 = Concentration measured at the SO_2 analyzer for the first 5 minute interval, ppm

T_m = Absolute average DGM temperature (see Figure 5-2), °K (°R).

T_{std} = Standard absolute temperature, 293°K (528°R).

V_m = Volume of gas sample as measured by dry gas meter, dcm (dcf).

$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

$V_{w(std)}$ = Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf).

W_{wt} = Wet wood weight.

Y = Dry gas meter calibration factor.

Y_{CO} = Measured mole fraction of CO (dry).

Y_{CO2} = Measured mole fraction of CO_2 (dry).

Y_{HC} = Assumed mole fraction of HC (dry);
=0.0088 for catalytic woodheaters
=0.0132 for noncatalytic woodheaters
=0.0080 for pellet fired woodheaters

θ = Total sampling time, min.

13.6 = Specific gravity of mercury.

60 = Sec/min.

100 = Conversion to percent.

M5H PARTICULATE SAMPLING TRAIN

1. Probe

   3/8" seamless SS-20" long. Outlet end of probe is attached to a SS outlet fitting with a Sweglock SS union. The probe is unheated except for the portion that is in the stack and the heated filter box. The probe is sealed to the stack with a washer.

2. Filter Holder

   A 3" or 4" standard M5 filter holder. A SS filter support with gasket.

3. Filters

   3" or 4" fiber glass (#25 glass) manufactured by Schleicher and Schuell.

4. Front Half Filter Heater

   A box containing a fan for air circulation and a cone heater. The temperature in the box is monitored with a type K thermocouple and adjusted with a voltage regulator to maintain a temperature below 248 °F.

5. Desiccant

   Indicating silica gel, 6-20 mesh. The silica gel is changed as needed.

6. Filter (Back Half) Holder

   Same as front half 3" or 4" filter.

7. Impinger Gas

   Type K thermocouple threaded into the exit "arm" of the impinger. Ice is added to the cooler whenever necessary to maintain an exit gas temperature less than 68 °F.

8. Meterbox

   RAC Stack Sampler modified by EEMC

   Ranges: 0-1.0" inclined water manometer

   0-10.0" vertical water manometer

   Accuracy: Dry gas Meter 0-999.999 cu ft ±1.0%

   Temperatures are monitored using two type K thermocouples.

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. <u>Operation</u>

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.

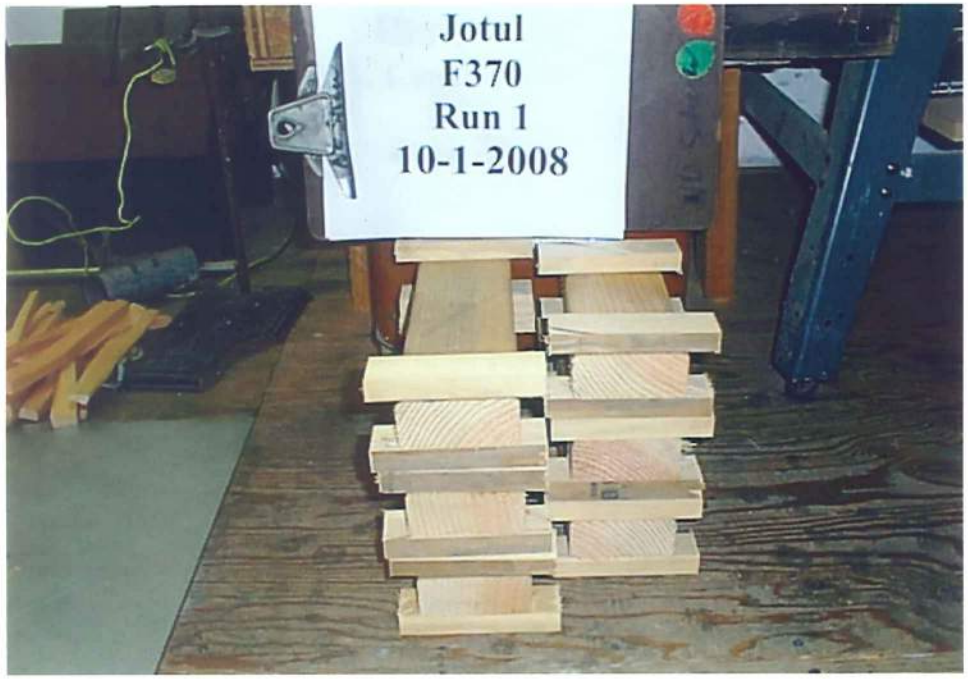
J. As necessary set the heat exchange blower(s) at the specified setting a minimum of one hour before the test is to begin.

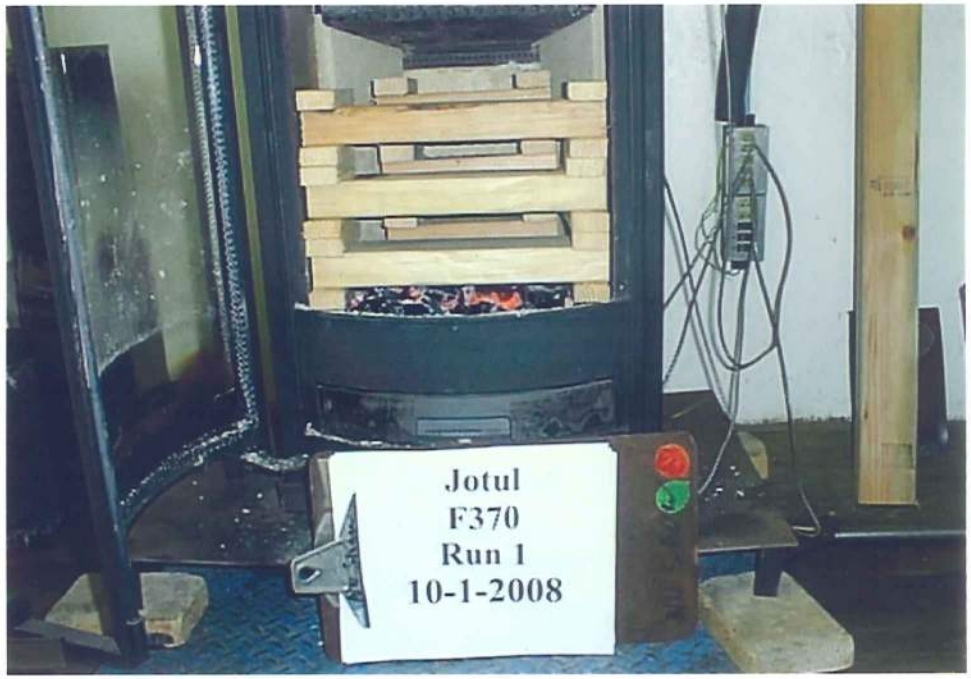
K. Record the stove surface temperatures, firebox and post catalytic or secondary burn temperatures and scale weigh for a minimum of one hour before the test run begins. As necessary add fuel, rake the coal bed, level the coal bed and/or remove coals during the first 45 minutes of the hour immediately preceding the start of the test. Record all information concerning raking, fuel additions, etc. on Data Sheet #13.

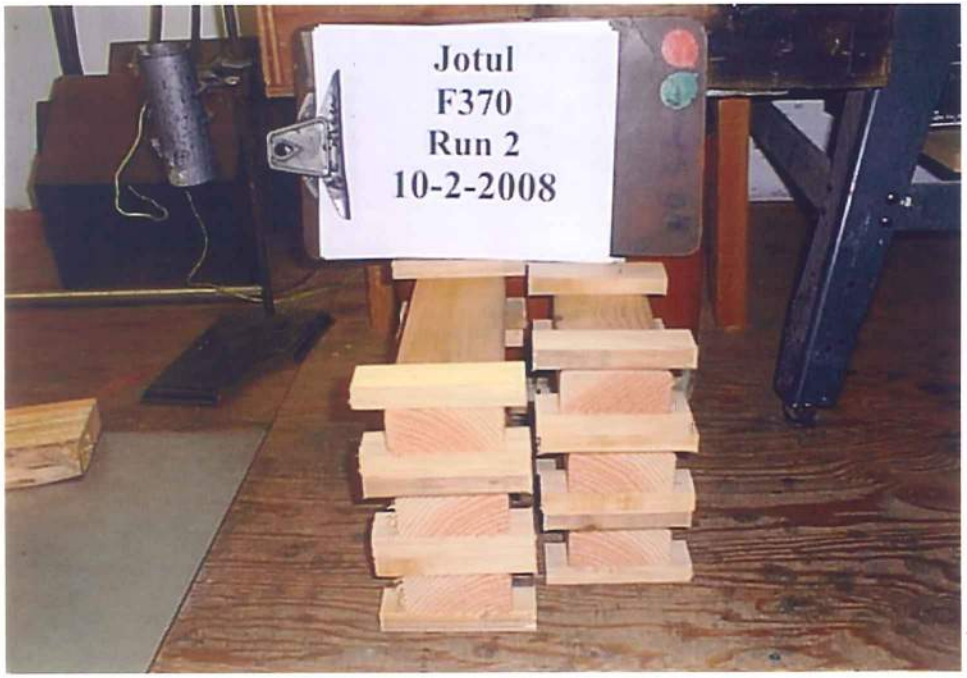
L. If necessary, sometime during the last 15 minutes before the start of the test, open the door and brake up all large pieces and then rake and level the pretest fuel in the stove. At this time, level the coal bed as necessary to accommodate loading the fuel charge into the stove. Close the door. Total 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.

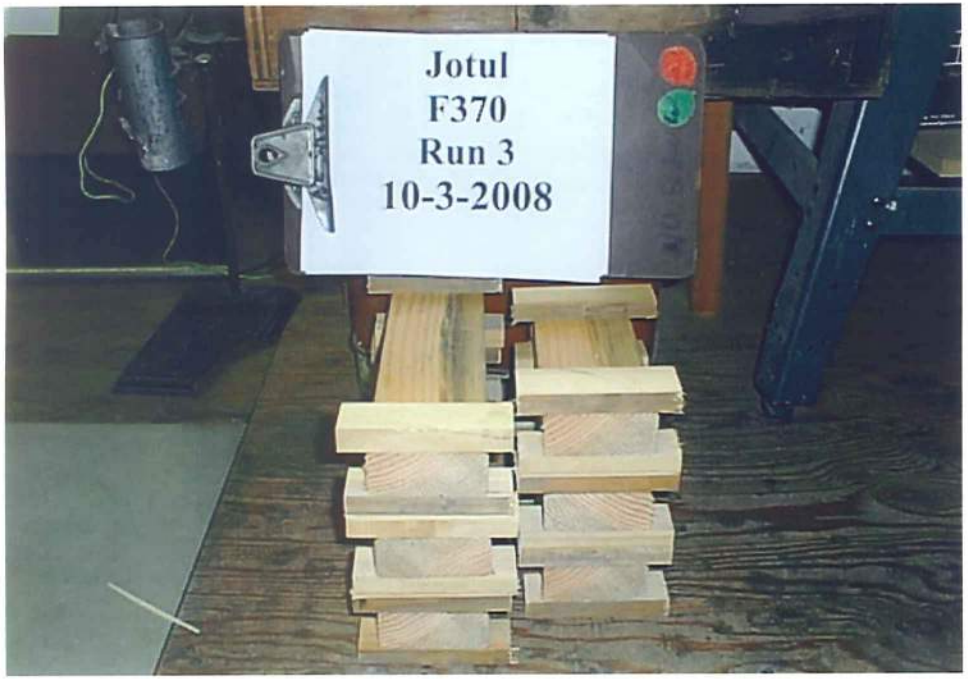
N. Document all stove operating data from ignition through loading and test start up on Data Sheet #9.


Jotul
F370
Run 1
10-1-2008


Jotul
F370
Run 1
10-1-2008

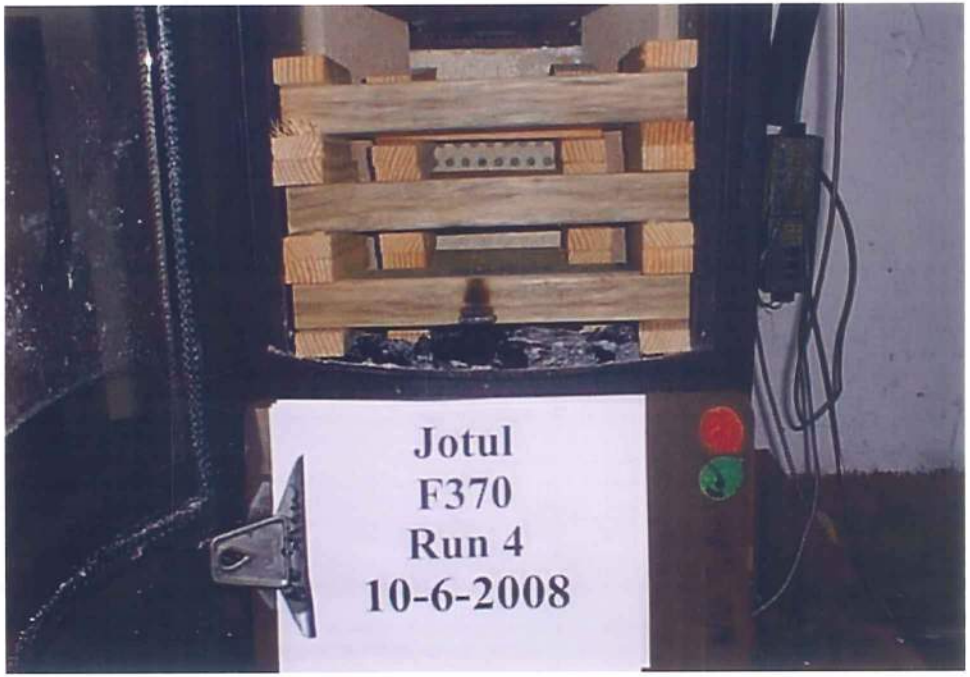

Jotul
F370
Run 2
10-2-2008

Jotul
F370
Run 2
10-2-2008


Jotul
F370
Run 3
10-3-2008

Jotul
F370
Run 3
10-3-2008

Jotul
F370
Run 4
10-6-2008


Jotul
F370
Run 4
10-6-2008