

United States
Environmental Protection Agency
Wood Heater Certification Test Report

Country Stoves, Inc.
1502 - 14th Street N.W.
Auburn, WA 98001

S210

Volume 1

Report By:

Chip Wadington
Deborah Wadington

CONFIDENTIAL

**RELEASED ONLY BY
AUTHORIZED PERSONNEL**

October 24, 2003

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TEST SERIES INFORMATION

Unit name and model number: S210

Type of unit: Wood Heater

Manufacturer: Country Stoves, Inc.
Address: 1502 – 14th Street N.W.
Auburn, WA 98001

Contact: Nick Pittman
Phone Number: 253-735-1100
Fax Number: 253-931-1271

Observers: None

Date Rcv'd: 10/06/2003 **Aged:** 10/09-13/2003 **Tested:** 10/13-16/2003

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

Test Location: 13235 Prairie Circle East
Sumner, WA 98390-7250

Test Site Elevation: 500 feet above sea level

LoKee's Field Team

Team Members: Chip Wadington
Deborah Wadington

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

Model: Country Stoves SZ10

Date: 10/11/03

13.29 feet

SO₂ SAMPLING

14.46 feet
Stack Height

8.46 feet

FLOW RATE
MEASUREMENT

9.13 feet

SO₂ INJECTION

8.13 feet

PARTICULATE
SAMPLE

OIL SEAL

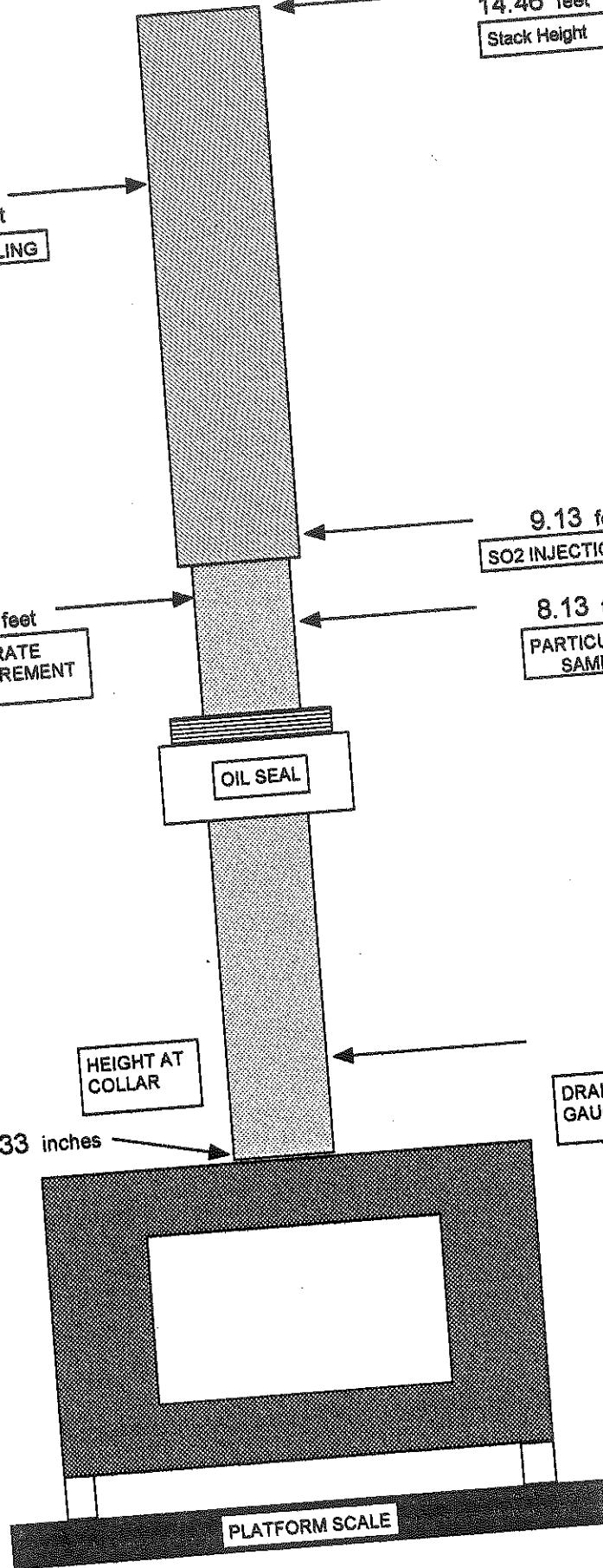
HEIGHT AT
COLLAR

33 inches

7 inches

DRAFT
GAUGE

PLATFORM SCALE



AGING DATA SHEET

UNIT: S 210 COUNTRY STOVES DATE: 10-9-03

Hr #	DATE	TIME	TEMP TOP 1	TEMP SECONDARY
1	10-9	1115	462	1290
2	"	1215	485	1180
3	"	1315	642	1388
4	"	1415	318	1058
5	"	1515	354	1072
6	"	1615	489	1226
7	"	1715	335	937
8	"	1815	291	839
9	10-13	1210	407	1269
10	"	1310	641	1539
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

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

COMMENTS:

Stove Lit 10-9 @ 10:45

Wood Heater Emission Test Summary

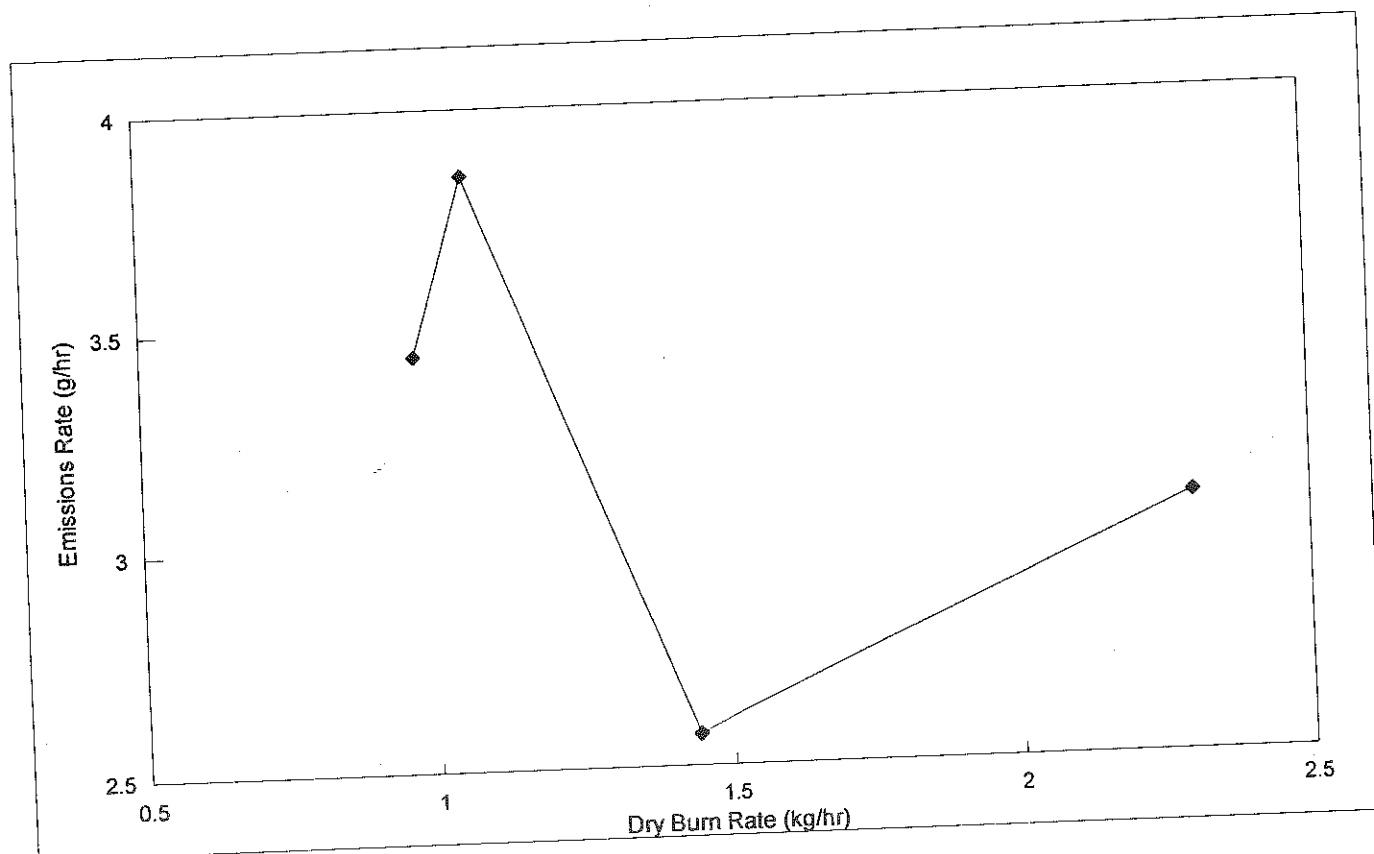
Laboratory/Wood Heater Information

Stove Manufacturer: COUNTRY STOVES, INC.
Model Identification: S210
-Stove Type- 2
1=cat, 2=noncat, 3=pellet:
Laboratory Name: LoKee Testing Laboratory
Laboratory Contact: CHIP WADINGTON
Telephone number: 360-897-9685

Test Dates: OCTOBER 13 - 16, 2003

-Test Methods Used- 28
Method 28/Other: 5H
Sampling Method:

Run no.	Burn Rate (kg/hr)	Emission Rate (g/hr)	Heat Output (Btu/hr)	Wtd Avg (g/hr) 3.18
4	0.97	3.44	11696	
2	1.06	3.85	12782	
1	1.44	2.57	17364	
3	2.30	3.08	27734	



Dated June

DATA SUMMARY

Unit : Country Stoves, Inc. - S210

	RUN #	4	2	1	3		
Particulate Emissions:							
Concentration:	grams/dscf:	.1602	.1611	.0846	.0560		
Emissions Rate	grams/hr:	3.44	3.85	2.57	3.08		
Emissions Factor	grams/kg:	3.56	3.62	1.79	1.34		
Front Half Catch	% of total	34.9	37.1	42.0	59.3		
Total Mass Captured	total catch:	1.0422	.9377	.3263	.1534		
Heat Output (EPA Default):	BTU/hr	11,643.8	12,823.5	17,333.9	27,703.8		
Fuel Burn Rates:							
Average kg/hr (dry)	Kg/hr	0.97	1.06	1.44	2.30		
Fuel Moisture Content:							
Kindling (wet basis)	%	12.587	11.765	14.310	13.270		
Prefest Fuel (wet basis)	%	18.390	17.898	17.673	16.915		
Test Fuel (wet basis)	%	18.122	17.596	17.709	18.220		
Air to Fuel Ratio		N/A	N/A	N/A	N/A		
Average Stack Gas							
Avg CO ₂	%	7.71	7.97	8.44	8.02		
Avg O ₂	%	N/A	N/A	N/A	N/A		
Avg CO	%	1.48	1.10	1.27	0.42		
Avg Moisture	%	6.53	7.02	7.83	7.05		
Avg Stack Gas Emissions:							
CO	g/Kg	170.23	128.20	139.12	52.15		
	g/hr	164.44	136.28	200.06	119.85		

COMPUTER INPUT DATA SHEET #1

Client: COUNTRY STOVES, INC.
 Address: 1502 14TH STREET NW
AUBURN, WA 98001
 Phone: 253-735-1100 Fax: 253-931-1271
 Run No.: 4 Date of Test: 10/16/03 Burn Rate: .966 ✓
 Model No.: S210 ☒ min ☐ min-1.25 ☐ fan-
 Stove Type: ☐ Cat ☒ Non Cat ☐ Pellet ☐ 1.25-1.9 ☐ max ☐ insert
 Dry Gas Meter Y Factor: .981 (0.000) (Data Sheet #2) Post Leak Rate: .007 cfm (0.000) (Data Sheet #2) Time: 330 min. (000) (Data Sheet #2)
 Dry Gas Meter Volume: 108.714 cf (00.000) (Data Sheet #2)
 Stack Flow: 7.210 dscfm ΔH : .159 in. H₂O (00.000) (Data Sheet #2)
 Maximum Vac.: 4.0 (0.0) (Data Sheet #2) Barometric Pressure: 29.71 in. Hg (00.00) (Data Sheet #2)
 H₂O Captured: 148.9 g (00.0) (Data Sheet #3)
 Front Half Catch % Of Total: 34.9 % Total Particulate Catch: 1.0422 g (00.000) (Data Sheet #6)
 Flue Gas Moisture: 6.5262 % (00.000) (Data Sheet #7)
 Particulate Emission: 1602 gr/dscf (0.0000) (Data Sheet #7)
 Relative Humidity: 39.0 % RH Ambient Moisture: 1.55 % H₂O (00.0) (Data Sheet #8)
 Preburn Fuel Wt.: 53.9 lbs. Coal Bed Wt.: 3.1 lbs. Test Fuel Wt.: 14.3 lbs. (00.0) (Data Sheet #8)
 Heat Output (EPA Default): 11,643.8 BTU/hr (00,000.0) (Data Sheet #8)
 Kindling Fuel % Moisture (wet): 12.587 % Pretest Fuel % Moisture (wet): 18.390 % (00.000) (Data Sheet #10)
 Test Fuel % Moisture (dry): 22.133 % Test Fuel % Moisture (wet): 18.122 % (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: -.043 in. H₂O (+/- .000) (Data Sheet #12)
 Average Ambient Temperature: 80 °F Stove Temperature Change: -81.3 °F (00) (Data Sheet #14) (+/- 000.0) (Data Sheet #14)

Minimum
DBR

TABLE 1 ----- RAW DATA

CLIENT : Country Stoves, Inc.

TEST No. :

4

MODEL: S210

DATE: 16-Oct-03

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	719.000	0.150	96	1.86	6.40	475
5	720.500	0.530	96	0.44	5.80	250
10	723.518	0.130	96	0.68	3.20	500
15	725.031	0.130	96	0.68	3.60	500
20	726.543	0.150	96	0.65	4.40	475
25	728.134	0.150	95	0.68	6.40	475
30	729.720	0.150	95	0.63	6.10	475
35	731.306	0.180	95	0.53	10.30	425
40	733.078	0.160	95	0.81	8.00	450
45	734.752	0.180	95	0.77	8.10	425
50	736.524	0.210	95	0.43	10.30	400
55	738.407	0.180	95	0.78	8.60	425
60	740.179	0.180	95	0.59	9.80	425
65	741.948	0.210	95	0.86	8.80	400
70	743.827	0.150	95	0.86	8.80	475
75	745.409	0.170	95	1.31	7.30	450
80	747.080	0.150	95	1.27	7.40	450
85	748.662	0.170	95	1.16	7.70	475
90	750.333	0.170	95	1.02	8.60	450
95	752.003	0.180	95	1.02	9.10	450
100	753.772	0.210	95	0.81	11.20	425
105	755.651	0.170	95	0.77	12.20	400
110	757.321	0.180	95	0.90	12.50	450
115	759.090	0.180	95	0.90	13.60	425
120	760.858	0.180	95	0.77	14.00	425
125	762.629	0.210	95	0.62	13.50	425
130	764.511	0.210	95	0.65	13.60	400
135	766.392	0.180	95	0.86	14.20	425
140	768.163	0.180	95	0.81	13.60	425
145	769.934	0.180	95	0.74	13.30	425
150	771.705	0.180	95	0.66	13.40	425
155	773.476	0.210	95	0.42	12.90	400
160	775.357	0.180	95	0.66	11.50	425
165	777.128	0.150	96	0.42	11.10	475
170	778.719	0.150	97	0.53	8.70	475
175	780.315	0.150	97	1.06	7.80	475
180	781.911	0.150	97	1.31	7.40	475
185	783.513	0.150	98	1.57	7.40	475
190	785.115	0.160	98	1.60	7.40	450
195	786.806	0.160	98	1.63	7.30	450
200	788.497	0.160	98	1.63	7.40	450
205	790.188	0.160	98	1.72	7.10	450
210	791.879	0.160	98	1.86	6.90	450
215	793.570	0.160	98	1.87	6.70	450
				1.98		
				2.13		

220	795.261	0.130	98	2.17	6.70	500
225	796.783	0.120	98	2.04	6.20	525
230	798.233	0.120	98	2.21	5.80	525
235	799.682	0.130	100	2.31	5.70	500
240	801.215	0.130	101	2.40	5.50	500
245	802.754	0.120	101	2.78	5.10	525
250	804.219	0.130	101	2.71	4.90	500
255	805.757	0.130	101	2.67	4.80	500
260	807.296	0.130	101	2.63	4.70	500
265	808.834	0.130	101	2.71	4.80	500
270	810.373	0.130	101	2.65	4.70	525
275	811.911	0.120	101	2.61	4.70	525
280	813.376	0.120	101	2.56	4.70	550
285	814.842	0.110	101	2.48	5.30	550
290	816.240	0.110	101	2.38	5.20	550
295	817.639	0.110	101	2.38	5.20	550
300	819.038	0.110	101	2.38	5.20	525
305	820.439	0.120	101	2.51	4.70	525
310	821.908	0.120	101	2.20	4.30	525
315	823.376	0.120	101	2.03	4.00	525
320	824.844	0.120	101	2.01	4.00	550
325	826.312	0.110	101	1.79	4.30	550
330	827.714	0.110	101	1.83	4.20	
335						

TABLE 2---RAW DATA

CLIENT : Country Stoves, Inc.

TEST No.

4

DATE: 16-Oct-03

MODEL: S210

METER CAL. FACTOR (Y) -----	0.981	Wt. WOOD BURNED (LB) -----	14.3	Lbs
BAROMETRIC PRESS. (Pb) -----	29.71 in Hg	WET, FUEL MOISTURE % -----	18.122	%
LEAK RATE POST (Lp) -----	0.007 cfm	Wt. PART. COLLECTED -----	1.0422	g
WATER VOL. (V1c) -----	148.9 Ml	METER VOLUME Vm -----	108.714	mcf
TEST TIME (MIN) -----	330 min	HC MOLE FRACTION -----	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT :Country Stoves, Inc.

TEST No. 4

MODEL: S210

DATE: 16-Oct-03

AVG DELTA H	----- 0.16 in H2O	AVG PRCNT CO	----- 1.48	%
AVG METER TEMP. Tm	----- 97 deg F	AVG PRCNT CO2	----- 7.71	%
AVG PPM SO2	----- 468 PPM	AVG BAL CO2/CO	----- 5.20	%

TABLE 4 ----- CALCULATIONS

CLIENT : Country Stoves, Inc.

TEST No. 4

MODEL: S210

DATE: 16-Oct-03

STD SAMPLE		STACK GAS		
VOL. Vm(std) -----	100.37 dscf	FLOW Qsd -----	331.111	dscf/Hr
			5.52	& dscf/min
VOL. WATER		PARTICULATE		
VAPOR Vw(std) ----	7.009 scf	CONCTRT. Cs -----	0.0104	g/dscf
PRCNT		PARTC. EMISS.		
MSTR Bws -----	6.53 %	RATE E -----	3.44	g/Hr
BURN		MOLES OF GAS		
RATE BR -----	0.97 Kg/Hr	PER Lb WOOD Nt --	0.40	Lb-mole/Lb
CO EMISSION		PART. EMISS.		
RATE -----	164.44 g/Hr	RATE -----	3.56	g/Kgdry
	&			fuel
	170.23 g/Kgdry			
	fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Country Stoves, Inc.

TEST No. : 4

MODEL: S210

DATE: 16-Oct-03

TIME INTERVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
=====	=====	=====	=====
5	659.5	94	100
10	699.0	100	
15	700.1	100	
20	699.7	100	
25	700.1	100	
30	698.5	100	
35	698.5	100	
40	698.3	100	
45	698.5	100	
50	698.3	100	
55	698.5	100	
60	698.3	100	
65	697.2	100	
70	697.0	100	
75	696.8	99	
80	697.3	100	
85	696.8	99	
90	697.3	100	
95	696.8	100	
100	697.2	100	
105	697.0	100	
110	696.8	100	
115	697.2	100	
120	696.8	99	
125	697.9	100	
130	698.1	100	
135	697.7	100	
140	697.9	100	
145	697.9	100	
150	697.9	100	
155	697.9	100	
160	697.7	100	
165	697.3	100	
170	698.8	100	
175	700.4	100	
180	699.8	100	
185	701.8	100	
190	701.8	100	
195	701.8	100	
200	701.8	100	
205	701.8	100	
210	701.8	100	
215	701.8	100	
220	701.8	100	

225	701.8	100
230	702.0	100
235	700.3	100
240	703.7	100
245	705.8	101
250	705.5	101
255	705.4	101
260	705.8	101
265	705.4	101
270	705.8	101
275	705.4	101
280	705.5	101
285	706.0	101
290	705.2	101
295	705.8	101
300	705.8	101
305	706.8	101
310	707.4	101
315	706.9	101
320	706.9	101
325	706.9	101
330	707.3	101
335		
340		

METER BOX DATA SHEET PAGE # 2

Page: 1 of 3

UNIT: COUNTRY STOVES - S210 RUN: 4 DATE: 10/16/03

Meter Box: 5H Y Factor: .981

Leak checks: 15 " Hg @ .012 cfm _____ " Hg @ _____ cfm

OK @ 12 15 " Hg @ .1007 cfm _____ " Hg @ _____ cfm

Inject SO₂ @ 100 cc/min. Nozzle: Probe @ 3/8" od Initial Volume: 1.500

ROTO PRESS: <u>.16</u>			SAMPLING RATIO: <u>.23</u> : 1				BP: <u>29.70</u>		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1245	719.000	_____	7.012	.15	96	475	96	1.0
5	50	720.500	_____	13.323	.53	96	250	96	4.0
10	55	723.518	723.518	6.662	.13	96	500	96	1.0
15	1300	725.031	725.031	6.662	.13	96	500	96	1.0
20	05	726.543	726.543	7.012	.15	96	475	96	1.0
25	10	728.134	728.134	7.025	.15	95	475	95	1.0
30	15	729.720	729.720	7.025	.15	95	475	95	1.0
35	20	731.306	731.306	7.851	.18	95	425	95	1.0
40	25	733.078	733.078	7.415	.16	95	450	95	1.0
45	30	734.752	734.752	7.851	.18	95	425	95	1.0
50	35	736.524	736.524	8.342	.21	95	400	95	2.0
55	40	738.407	738.407	7.851	.18	95	425	95	2.0
ROTO PRESS: <u>.16</u>			TOTALS: 94.031				BP: <u>29.76</u>		
60	1345	740.179	740.179	7.867	.18	95	425	95	2.0
65	50	741.948	741.948	8.359	.21	95	400	95	2.0
70	55	743.827	743.827	7.039	.15	95	475	95	2.0
75	1400	745.409	745.409	7.430	.17	95	450	95	2.0
80	05	747.080	747.080	7.039	.15	95	475	95	2.0
85	10	748.662	748.662	7.430	.17	95	450	95	2.0
90	15	750.333	750.333	7.430	.17	95	450	95	2.0
95	20	752.003	752.003	7.867	.18	95	425	95	2.0
100	25	753.772	753.772	8.359	.21	95	400	95	2.0
105	30	755.651	755.651	7.430	.17	95	450	95	2.0
110	35	757.321	757.321	7.867	.18	95	425	95	2.0
115	40	759.090	759.090	7.867	.18	95	425	95	2.0
			TOTALS: 91.989				MAX VACC =		
TOTAL Cu Ft.			TOTALS: 186.015				AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 3
DATE: 10-16-03

UNIT: Country Stores 5210 RUN: 4

Meter Box: 5H Y Factor: .981

Leak checks: 15 " Hg @ .012 cfm
15 " Hg @ .007 cfm

" Hg @ cfm
" Hg @ cfm
Initial Volume: 1,500

Inject SO₂ @ 100 cc/min.

Nozzle: Probe @ 3/8" od

ROTO: PRESS: <u>.16</u>			SAMPLING RATIO: <u>.23</u>		: 1		BP: <u>29.72</u>		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1445	760.858	760.858	7.857	.18	95	425	95	2.0
125	50	762.629	762.629	8.348	.21	95	400	95	2.0
130	55	764.511	764.511	8.348	.21	95	400	95	2.0
135	1500	766.392	766.392	7.857	.18	95	425	95	2.0
140	05	768.163	768.163	7.857	.18	95	425	95	2.0
145	10	769.934	769.934	7.857	.18	95	425	95	2.0
150	15	771.705	771.705	7.857	.18	95	425	95	2.0
155	20	773.476	773.476	8.348	.21	95	400	95	2.0
160	25	775.357	775.357	7.857	.18	95	425	95	2.0
165	30	777.128	777.128	7.017	.15	96	475	96	2.0
170	35	778.719	778.719	7.004	.15	97	475	97	2.0
175	40	780.315	780.315	7.004	.15	97	475	97	2.0
ROTO PRESS: <u>.16</u>			TOTALS: 93.211		2.16	1145	BP: 29.72		
180	1545	781.911	781.911	6.992	.15	98	475	98	2.0
185	50	783.513	783.513	6.992	.15	98	475	98	2.0
190	55	785.115	785.115	7.380	.16	98	450	98	2.0
195	1600	786.806	786.806	7.380	.16	98	450	98	2.0
200	05	788.497	788.497	7.380	.16	98	450	98	2.0
205	10	790.188	790.188	7.380	.16	98	450	98	2.0
210	15	791.879	791.879	7.380	.16	98	450	98	2.0
215	20	793.570	793.570	7.380	.16	98	450	98	2.0
220	25	795.261	795.261	6.642	.13	98	500	98	2.0
225	30	796.783	796.783	6.326	.12	98	525	98	2.0
230	35	798.233	798.233	6.326	.12	98	525	98	2.0
235	40	799.682	799.682	6.619	.13	100	500	100	2.0
			TOTALS: 84.177		1.76	1178	MAX VACC =		
TOTAL Cu Ft.			TOTALS: 177.388		3.92	2323	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 3 of 3

UNIT: Country Stoves S210 RUN: 4

DATE: 10-16-03

Meter Box: 5H Y Factor: .981

Leak checks: 15 " Hg @ .012 cfm

" Hg @ cfm

15 " Hg @ .007 cfm

" Hg @ cfm

Inject SO₂ @ 100 cc/min.

Nozzle: Probe @ 3/8" od

Initial Volume: 1,500

Inject SO ² @ 100 cc/min.			Nozzle: Probe @ 3/8" od			Initial Volume					
ROTO PRESS: .16			SAMPLING RATIO: 23			: 1			BP: 29.72		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC		
240	1645	801.215	801.215	6.607	.13	101	500	101	2.0		
245	50	802.754	802.754	6.292	.12	101	525	101	2.0		
250	55	804.219	804.219	6.607	.13	101	500	101	2.0		
255	1700	805.757	805.757	6.607	.13	101	500	101	2.0		
260	05	807.296	807.296	6.607	.13	101	500	101	2.0		
265	10	808.834	808.834	6.607	.13	101	500	101	2.0		
270	15	810.373	810.373	6.607	.13	101	500	101	2.0		
275	20	811.911	811.911	6.292	.12	101	525	101	2.0		
280	25	813.376	813.376	6.292	.12	101	525	101	2.0		
285	30	814.842	814.842	6.006	.11	101	550	101	2.0		
290	35	816.240	816.240	6.006	.11	101	550	101	2.0		
295	40	817.038	817.639	6.006	.11	101	550	101	2.0		
ROTO PRESS: .16			TOTALS: 76.536			1.47	1212	BP: 29.66			
300	1745	819.038	819.038	5.994	.11	101	550	101	2.0		
305	50	820.439	820.439	6.279	.12	101	525	101	2.0		
310	55	821.908	821.908	6.279	.12	101	525	101	2.0		
315	1800	823.376	823.376	6.279	.12	101	525	101	2.0		
320	05	824.844	824.844	6.279	.12	101	525	101	2.0		
325	10	826.312	826.312	5.994	.11	101	550	101	2.0		
330	15	827.714	827.714	5.994	.11	101	550	101	2.0		
335											
340			2.67 ✓	43.098	.81	707					
345				119.634	2.28	1919					
350											
355				483.037	10.62	6527					
			TOTALS:			97	MAX VACC =			4.0	
TOTAL Cu Ft. 108.714			TOTALS:			7.210	.159	557	AVG. BP: 29.71		

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT: COUNTRY STOVES-S212 RUN: 4 DATE: 10/16/03

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

SCALE	WEIGHT
295.0 g	295.0
590.0 g	590.0
885.0 g	885.0

	#1	#2	#3	#4
IMPINGER				
FINAL WT	742.0	589.7	485.9	896.9
INITIAL WT	612.2	582.7	484.0	886.7
NET WT GRAMS	129.8	7.0	1.9	10.2

TOTAL CATCH: 148.9 GRAMS H₂O

FRONT HALF

FILTER #	178F	
FINAL WT g	9273	✓
INITIAL WT g	6912	✓
NET WT g	2361	✓

BEAKER #	141
DESC.	ACETONE
FINAL WT g	102.4113
INITIAL WT g	102.2833
NET WT g	.1280
VOL. DESC. ml	50

BACK HALF

FILTER #	178B	
FINAL WT g	5423	✓
INITIAL WT g	4350	✓
NET WT g	1073	✓

BEAKER #	142	143	144	145	
DESC.	ACETONE	METHCHLOR	H ₂ O	H ₂ O	
FINAL WT g	108.1319	105.6270	106.4631	101.6463	
INITIAL WT g	107.8146	105.5923	106.3817	101.5221	
NET WT g	.3179	.0547	.0814	.1242	.2056
VOL. DESC ml	150	75	150	200	(350)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : _____ Date : 05/12/2003 Time : 1215 By : DKW
 Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : ZB921
 Back Size : 8.2 cm Lot No. : ZB911

DATE: <u>05-15-03</u>		BY: <u>DKW</u>	DATE: <u>05-16-03</u>		BY: <u>DKW</u>	DATE: _____	BY: _____
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME	
171F	.6931	1133	.6931	0942	HEARTHSTONE-TRIBUTE R-2		
172F	.6967	1134	.6966	0943	" "	R-3	
173F	.6934	1135	.6935	0944	" "	R-4	
174F	.6998	1136	.6997	0945	" "	R-5	
175F	.6955	1137	.6955	0946	COUNTRY STORES-S210 R#1		
176F	.6973	1137	.6972	0946	" "	R-2	
177F	.6943	1138	.6941	0947	" "	R-3	
178F	.6911	1139	.6912	0948	" "	R-4	
179F	.6963	1140	.6964	0949			
180F	.6931	1141	.6931	0950			

171B	.4319	1151	.4320	0958	HEARTHSTONE-TRIBUTE R-2		
172B	.4326	1151	.4325	0959	" "	R-3	
173B	.4259	1152	.4260	1000	" "	R-4	
174B	.4310	1153	.4307	1001	" "	R-5	
175B	.4282	1154	.4284	1001	COUNTRY STORES-S210 R#1		
176B	.4238	1155	.4239	1002	" "	R-2	
177B	.4311	1156	.4309	1003	" "	R-3	
178B	.4351	1157	.4350	1004	" "	R-4	
179B	.4299	1158	.4300	1005			
180B	.4311	1158	.4309	1005			

Checked by: G. W. Wainwright Date: 5-16-03 Time: 1241

SCALE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	DB	% RH
05-15	1120	DKW	78	46
05-16	0930	DKW	73	45

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: ⁰⁹ Date: ⁰⁹ 18/2003 Time: ⁰⁹⁰⁰ By: ^{DKW}

BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
126	105.7690	0838	105.7694	1013	COUNTRY STONES-S210 R#1	
127	104.0768	0839	104.0771	1014		
128	105.6108	0840	105.6109	1015		
129	106.4315	0841	106.4320	1016		
130	106.5054	0843	106.5058	1018		
131	106.8471	0844	106.8475	1019	COUNTRY STONES-S210 R#2	
132	105.3860	0845	105.3862	1020		
133	106.5070	0846	106.5067	1021		
134	107.6923	0847	107.6926	1023		
135	104.5961	0848	104.5958	1024		
136	107.0835	0849	107.0840	1025	COUNTRY STONES-S216 R#3	
137	104.1653	0850	104.1651	1027		
138	105.2454	0851	105.2450	1028		
139	104.4051	0852	104.4055	1029		
140	106.9637	0853	106.9640	1031		
141	102.2830	0854	102.2833	1032	COUNTRY STONES-S210 R#4	
142	107.8136	0855	107.8140	1033		
143	105.5725	0856	105.5723	1035		
144	106.3813	0857	106.3817	1036		
145	101.5218	0858	101.5221	1037		
146	101.3692	0859	101.3694	1039		
147	106.9572	0860	106.9574	1040		
148	104.7573	0861	104.7577	1041		
149	107.5469	0862	107.5472	1042		
150	106.7053	0863	106.7055	1044		

SCALE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	DB	% RH	Checked by:
09/24	0835	RW	75	47	Chp W. W. W.
09/25	1010	RW	76	49	Date: 9-25-03
					Time: 1150

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

Page: 1 of 1

DATE: 10/16/03

RUN: 4

UNIT: COUNTRY STOVES - S210

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
141	10/17	2245	By	102.4125	10/19	1235	By	102.4113	10/20	1529	By
142	10/17	2245	By	108.1337	10/19	1236	By	108.1323	10/20	1530	By
143	10/17	2245	By	105.6284	10/19	1237	By	105.6272	10/20	1531	By
144	10/17	2245	By	106.4635	10/19	1238	By	106.4631	10/20	1532	By
145	10/17	2245	By	101.6467	10/19	1239	By	101.6463	10/20	1533	By

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
178F	10/16	1900	Op	92.75	10/17	1606	By	92.73	10/19	1240	By
178B	10-16	1400	Op	54.27	10/17	1627	By	54.23	10/19	1241	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	10/17	1600	By	78	48
2	10/19	1210	By	78	48
3	10/20	1520	By	78	49
4	10/21	1320	By	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 02-24-2003 Through 06-18-2003	Scale: Sartorius	Model: A 120 S	SN: 37010004
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100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9998	10.000	1.0000	.0999	AKL	02-24	1055	74	44
99.9997	9.9998	1.0001	.0999	AKL	02-25	1700	77	45
100.0000	10.0001	1.0000	.0998	AKL	03-01	1010	71	44
99.9997	10.0001	.9998	.0999	AKL	03-02	1420	75	45
99.9998	10.0000	.9999	.1000	AKL	03-03	1205	76	45
99.9998	10.0000	1.0000	.1000	AKL	03-03	2005	77	47
99.9998	10.0000	1.0000	.0999	AKL	03-04	1035	75	47
100.0000	10.0001	1.0001	.0999	AKL	03-05	0945	71	47
99.9996	10.0001	1.0000	.0999	AKL	03-06	1340	74	46
99.9997	10.0001	1.0000	.1000	AKL	03-07	2050	76	45
99.9998	9.9999	1.0000	.0998	AKL	03-08	1150	77	45
99.9998	9.9999	1.0000	.0999	AKL	03-09	1350	76	45
99.9997	9.9998	1.0000	.1000	AKL	03-10	1220	77	47
99.9998	10.0000	.9999	.1000	AKL	03-18	1740	77	46
99.9997	9.9999	1.0000	.1000	AKL	03-20	2145	74	45
99.9997	9.9999	1.0000	.0999	AKL	03-22	1725	76	47
99.9998	10.0000	1.0000	.0998	AKL	03-23	1405	77	47
99.9997	10.0000	.9999	.1000	AKL	03-24	1450	74	44
99.9998	9.9998	.9999	.0999	AKL	03-25	1120	75	45
100.0000	9.9998	1.0000	.0998	AKL	04-30	2300	75	47
99.9998	10.0000	.9999	.0999	AKL	05-02	1130	77	49
99.9997	10.0001	.9999	.1000	AKL	05-06	2135	77	46
99.9998	9.9998	1.0000	.0999	AKL	05-09	0715	77	45
99.9997	9.9999	1.0001	.0999	AKL	05-10	1435	78	47
99.9998	10.0000	.9999	.0999	AKL	05-11	1210	77	46
99.9998	9.9999	1.0000	.0998	AKL	05-12	0940	76	45
99.9999	10.0001	.9999	.0999	AKL	05-13	0910	77	46
10.0001	10.0000	.9999	.1000	AKL	05-15	1120	78	46
99.9999	10.0001	1.0000	.0999	AKL	05-16	0930	73	45
99.9997	9.9999	1.0000	.0999	AKL	05-17	1105	74	46
100.0001	10.0000	.9999	.0999	AKL	05-18	1550	77	48
100.0000	9.9999	1.0000	.1000	AKL	06-04	1025	76	46
99.9997	10.0000	.9999	.0999	AKL	06-06	1035	78	49
99.9998	9.9999	1.0000	.0999	AKL	06-12	0950	73	43
99.9998	9.9999	1.0000	.0999	AKL	06-13	2115	78	46
99.9997	10.0002	1.0000	.0998	AKL	06-14	1110	78	46
99.9998	10.0000	1.0000	.0999	AKL	06-15	1110	78	47
99.9997	9.9999	1.0000	.1000	AKL	06-17	0905	78	48
99.9998	10.0001	1.0000	.1001	AKL	06-18	1025	78	47
99.9998	10.0000	.9999	.1000	AKL				

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 06-19-2003 Through 10-20-2003	Scale: Sartorius	Model: A 120 S	SN: 37010004
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100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0000	0.9999	.1001	BM	06/19	0955	77	48
100.0000	10.0000	1.0000	.0999	BM	06/19	1040	75	48
99.9998	9.9998	1.0000	.0999	BM	07/23	0840	78	47
99.9997	9.9998	.9999	.0998	BM	07/24	1200	78	48
99.9997	9.9999	.9999	.0997	BM	07/25	0845	76	47
99.9999	10.0001	1.0000	.0999	BM	07/26	1040	78	49
99.9999	9.9998	1.0000	.0998	BM	07/27	1135	77	48
99.9999	10.0000	1.0000	.0999	BM	07/29	2045	78	48
99.9997	9.9999	.9999	.0999	BM	07/30	2100	77	48
99.9998	9.9998	.9999	.0999	BM	08/01	1205	77	47
100.0000	10.0000	.9999	.0998	BM	08/28	0915	74	49
99.9999	10.0000	1.0000	.0997	BM	08/29	0715	78	46
99.9997	10.0001	.9998	.0997	BM	09/02	0930	77	48
99.9997	10.0000	.9999	.0999	BM	09/03	0815	77	48
99.9999	9.9999	1.0000	.1000	BM	09/04	0855	78	49
99.9998	9.9999	1.0000	.0999	BM	09/05	1110	78	48
99.9997	10.0000	.9998	.0998	BM	09/06	1940	78	49
99.9997	9.9999	1.0000	.1000	BM	09/07	1235	77	48
99.9997	9.9998	.9999	.0999	BM	09/08	1025	76	47
99.9998	9.9999	1.0000	.0999	BM	09/09	0915	78	47
99.9998	10.0000	1.0000	.1000	BM	09/16	1030	76	48
99.9999	10.0001	1.0000	.1000	BM	09/17	1145	77	46
99.9997	9.9999	.9999	.1000	BM	09/24	0835	75	47
99.9997	10.0000	1.0000	.0999	BM	09/25	1010	76	49
100.0000	10.0001	1.0000	.0999	BM	09/30	1115	75	47
99.9997	9.9998	.9999	.1000	BM	10/02	0955	77	49
99.9997	9.9998	1.0000	.0999	BM	10/03	0850	77	49
99.9997	9.9999	.9999	.1000	BM	10/04	1825	77	46
99.9997	9.9998	.9999	.0998	BM	10/05	1555	77	49
99.9999	10.0000	1.0000	.0999	BM	10/06	1105	77	46
99.9999	9.9999	1.0000	.1000	BM	10/07	2020	77	46
99.9999	10.0000	.9999	.1000	BM	10/08	1015	74	47
99.9999	9.9999	1.0001	.0998	BM	10/10	1830	75	47
99.9999	10.0000	.9999	.0998	BM	10/13	0945	78	49
99.9998	9.9999	1.0000	.1000	BM	10/14	1900	78	49
100.0000	9.9998	.9999	.0999	BM	10/15	2105	77	49
99.9999	9.9999	1.0000	.1000	BM	10/17	1600	78	48
99.9998	10.0001	.9999	.1000	BM	10/19	1210	78	48
99.9998	9.9999	1.0000	.0999	BM	10/20	1520	78	49

SCALE QA SHEET

Dates:
From 10-21-2003 Through

Scale:
Sartorius

Model:
A 120 S

SN:
37010004

[illegible]

BLANK PROCESSING DATA SHEET # 5

UNIT: COUNTRY STORES - 8210 RUN: 4 DATE: 10/16/03

DATE BLANKS DONE: 10/13/03

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 023283	FISHER OPTIMA LOT # 035941	DWNA, INC. SPARKLETES DISTILLED
FINAL WEIGHT	108.9015	106.3075	106.9665
TARE WEIGHT	108.8996	106.3060	106.9644
NET WEIGHT	.0019 ✓	.0015 ✓	.0021 ✓

TARE BEAKERS INTO DESC: TIME: 1635 DATE: 10/05/03

DATE: 10/07 BY: BZ DATE: 10/08 BY: BZ DATE: 10/09 BY: BZ

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8999	2038	108.8996	1021	✓	
B	106.3062	2039	106.3060	1022	✓	
C	106.9646	2040	106.9644	1023	✓	

FINAL BEAKERS INTO DESC: TIME: 0800 DATE: 10/09/03

DATE: 10/10 BY: BZ DATE: 10/13 BY: BZ DATE: 10/14 BY: BZ

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9013	0833	108.9015	0947	✓	
B	106.3070	0834	106.3075	0948	✓	
C	106.9664	0835	106.9665	0949	✓	

TARE QC

DATE	TIME	BY	WB	DB	%
10/07	2020	BZ		77	46
10/08	1015	BZ		74	47

FINAL QC

DATE	TIME	BY	WB	DB	%
10/10	0830	BZ		75	47
10/13	0945	BZ		78	49

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: COUNTRY STORES-S210 RUN: 4 DATE: 10/16/03

BLANK AUDIT: BY: C. Wadington DATE: 10-14-03

BLANK CALCULATIONS

Acetone: .0019 g ÷ 200 ml = .000010 g/ml ✓
 Dichloromethane: .0015 g ÷ 75 ml = .000020 g/ml ✓
 Distilled Water: .0021 g ÷ 200 ml = .000011 g/ml ✓

FRONT HALF CATCH

FILTERS: .2361 g - 1 (# of Filters) (.0000 g) Blank Value / Filter = .2361 g ✓
Total Catch

BEAKERS: .1280 g - 50 (ml Acetone) (.000010 g) Blank Value / ml Acetone = .1275 g ✓
Total Catch

TOTAL FRONT HALF CATCH: .3636 g ✓

BACK HALF CATCH

FILTERS: .1073 g - 1 (# of Filters) (.0000 g) Blank Value / Filter = .1073 g ✓
Total Catch

BEAKERS: .3179 g - 150 (ml Acetone) (.000010 g) Blank Value / ml Acetone = .3164 g ✓
Total Catch

Extract: .0547 g - 75 (ml Dichloromethane) (.000020 g) Blank Value / Dichloromethane = .0532 g ✓
Total Catch

Water: .2056 g - 350 (ml Water) (.000011 g) Blank Value / Water = .2017 g ✓
Total Catch

TOTAL BACK HALF CATCH: .6786 g ✓

TOTAL CATCH: 1.0422 g ✓

% FRONT HALF: 34.9 % ✓
(00.0)

CALCULATIONS DATA SHEET # 7

UNIT: COUNTRY STOVES - S210 RUN: 4 DATE: 10/16/03

$$1) Vm (std) = \frac{(108.714 Vm) (17.64) (.98/mcf) (29.71 \text{ " Hg} + \frac{.159 \text{ " H}_2\text{O}}{13.6})}{(557 \text{ TmA})} = \frac{100.3856}{000.0000} \text{ dscf}$$

$$2) Vw (std) = (.04707) (\underline{148.9 \text{ ml H}_2\text{O}}) = \frac{7.0087}{00.0000} \text{ scf}$$

$$3) Asw = \frac{(\underline{7.0087 \text{ scf}})}{(\underline{7.0087 \text{ scf} + 100.3856 \text{ dscf}})} = \frac{.0653}{.0000} \text{ Bws} \times 100 = \frac{6.5262}{00.0000} \% \text{ H}_2\text{O}$$

$$4) Cs = \frac{(\underline{1.0422 \text{ g}})}{(\underline{100.3856 \text{ dscf}})} (15.43) = \frac{.1602}{0.0000} \text{ gr / dscf}$$

$$5) \text{ Estimated g / hr} = \frac{(\underline{1.0422 \text{ g}})}{(\underline{100.3856 \text{ dscf}})} (\underline{7.210}) \text{ dscfm} (60) = \frac{4.4912}{00.0000} \text{ g / hr}$$

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 ₂ O =	average delta H for test	(p. 2)	(.000 " H ₂ O)
TmA =	average meter temperature for test in degrees Absolute	(p. 2)	(000 TmA)
ml H ₂ O =	total water caught during test	(p. 3)	(000.0 ml H ₂ O)
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: COUNTRY STOVES-8210 RUN: 4 DATE: 10/16/03

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

Wet Bulb / Dry Bulb Pre: WB: 68 DB: 86 = 38 % RH 1.7 % H₂O

Post: WB: 64 DB: 80 = 40 % RH 1.4 % H₂O

Average: 39.0 % RH 1.55 % H₂O

Empty Stove Weight (lbs): _____ w/ stack & oil seal: Wet: — Dry: 459.9

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

Preburn Fuel Weight: 18.4 + 15.0 + 15.8 Total: 49.2

Kindling & Preburn Fuel Weight (wood only) (lbs): Total: 53.9

Coal Bed Wt Range (lbs): 3.5 - 2.9 Scale: 463.4 - 462.8

Upper: .25 x fuel weight: Always round DOWN to nearest tenth Actual Coal Bed Weight: 3.1

Lower: .20 x fuel weight: Always round UP to nearest tenth

Maximum Coal Bed Removal (lbs): $(\frac{3.5}{\text{Upper}} + \frac{2.9}{\text{Lower}}) \div 2 \times .25 = \underline{.8}$ round down to nearest tenth

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

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" x 4"	16.5	3	6.8	47.6
4" x 4"	16.5	2	7.5	52.4

Test Fuel Weight: 14.3 lbs

Estimated Dry Burn Rate: $\frac{14.3 - (14.3 \times .18122)}{2.2046} \times \frac{60}{330} = \underline{.966}$ kg / hr

Estimated BTU's/hr: $19,140 \times \frac{63}{100} \times \frac{.966}{\text{DBR}} = \underline{11,643.8}$ BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit: COUNTRY STOVES - S210 Run: 4 Date: 10/16/03

FIRE STARTED: 0800

WARM UP AND PREBURN:

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

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

CHARCOAL BED PREPARATION:

Raked and leveled prior to each warm-up / preburn charge. At 1 1/2 min. prior to loading last fuel, raked and leveled. In stove 25 sec.

TEST:

DOOR wide open during loading 0 min. 55 sec.

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

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

FAN:

ON / ~~OFF~~ during warm-up

ON / ~~OFF~~ first 30 minutes of test

Fan speed set at Low

~~ON~~ / OFF during preburn

~~ON~~ / OFF balance of test run

WOOD DATA:

KINDLING: A mix of the grades listed below:

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

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

All Grades WCLB rules:

WARM UP INFORMATION:

All pre-burn / warm up fuel pieces were either 15 or 15 inches.

1st warm up / pre-burn fuel charge (18.4 lbs.) added at 0820

2nd warm up / pre-burn fuel charge (15.0 lbs.) added at 0920

3rd warm up / pre-burn fuel charge (13.9 lbs.) added at 1035

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 : COUNTRY STOVES - S210 Run : 4 Date : 10/16/03

Room Temperature : 73 °F Correction Factor : 0

Uncorrected Values are corrected for room temperature : Yes No ✓

Time Test Fuel moisture reading taken : 1040

Calibration Checks : X ✓ Y ✓ 12.0 ✓ 12.1 ✓ 22.0 ✓ 22.0 ✓

pc #	Dimen.	Use	TOP		BOTTOM		SIDE		Average Corrected
			Uncor.	Cor.	Uncor.	Cor.	Uncor.	Cor.	
1	2"x4"x8'	K	13.5	14.4	13.5	14.4	13.5	14.4	14.400
2									
3									
4	2"x4"x8'	P	21.0	22.5	22.0	23.7	22.0	23.7	23.300
5	2"x4"x8'	P	21.0	22.5	21.0	22.5	21.0	22.5	22.500
6	2"x4"x8'	P	19.0	20.3	18.5	19.8	18.5	19.8	19.967
7	2"x4"x8'	P	22.0	23.7	23.0	24.7	23.0	24.7	24.367
8	2"x4"x8'	P							90.134
9									
10									
11									
12	2"x4"x16.5"	T	19.0	20.3	14.0	20.3	19.0	20.3	20.300
13	2"x4"x16.5"	T	21.0	22.5	21.5	23.1	21.0	22.5	22.700
14	2"x4"x16.5"	T	22.0	23.7	22.0	23.7	22.0	23.7	23.700
15	4"x4"x16.5"	T	19.5	20.9	20.0	21.4	14.5	20.9	21.067
16	4"x4"x16.5"	T	21.0	22.5	21.5	23.1	21.5	23.1	22.900
17									110.667
18									
19									
20	Spacers	T	22.5	24.1	21.5	23.1	22.0	23.7	23.633

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	14.400 %	22.533 %	22.133 %
Wet Moisture % :	12.587 %	18.390 %	18.122 %

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

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

GAS DATA SHEET #12

WEIGHT: 463.0

DATE: 10/16/03

UNIT: COUNTRY STORES - S210

RUN: 4

PAGE: 1 OF 2

UNIT: COUNTRY STUDIES				- J210				RUN: 7		PAGE: 1		C: 1									
TIME	SCALE	FUEL	DROP	V.	CO ₂	V.	O ₂	V.	CO	STATIC	SO:PPM										
0	245	477.3	14.3	-	.255	6.4	.504	12.6	.185	1.86	7041	475									
5	50	476.7	13.7	.6	.234	5.8	.582	14.5	.044	.44	7053	250									
10	55	476.6	13.6	.1	.128	3.2	.679	16.9	.068	.68	7044	500									
15	1300	476.4	13.4	.2	.145	3.6	.662	16.5	.068	.68	7043	500									
20	05	476.1	13.1	.3	.175	4.4	.633	15.8	.065	.65	7043	475									
25	10	475.8	12.8	.3	.255	6.4	.552	13.8	.068	.68	7045	475									
30	15	475.5	12.5	.3	.243	6.1	.566	14.1	.063	.63	7045	475									
35	20	475.0	12.0	.5	.413	10.3	.399	10.0	.053	.53	7050	425									
40	25	474.6	11.6	.4	.320	8.0	.481	12.0	.081	.81	7050	450									
45	30	474.1	11.1	.5	.326	8.1	.477	11.9	.077	.77	7050	425									
50	35	473.8	10.8	.3	.413	10.3	.403	10.1	.043	.43	7051	400									
55	40	473.4	10.4	.4	.346	8.6	.456	11.4	.078	.78	7050	425									
SUBTOTAL											*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
60	1345	473.1	10.1	.3	.392	9.8	.418	10.4	.059	.59	7051	425									
65	50	472.6	9.6	.5	.354	8.8	.445	11.1	.086	.86	7052	400									
70	55	472.3	9.3	.3	.291	7.3	.491	12.2	.130	1.31	7049	475									
75	1400	472.0	9.0	.3	.297	7.4	.486	12.1	.126	1.27	7048	450									
80	05	471.7	8.7	.3	.309	7.7	.479	11.9	.115	1.16	7047	475									
85	10	471.4	8.4	.3	.343	8.6	.450	11.2	.101	1.02	7047	450									
90	15	471.0	8.0	.4	.365	9.1	.428	10.7	.101	1.02	7047	450									
95	20	470.7	7.7	.3	.450	11.2	.351	8.8	.081	.81	7050	425									
100	25	470.3	7.3	.4	.491	12.2	.312	7.8	.077	.77	7051	400									
105	30	469.8	6.8	.5	.500	12.5	.298	7.4	.090	.90	7051	450									
110	35	469.3	6.3	.5	.545	13.6	.251	6.3	.094	.95	7052	425									
115	40	468.9	5.9	.4	.560	14.0	.237	5.9	.090	.90	7053	425									
SUBTOTAL											*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
120	1445	468.4	5.4	.5	.542	13.5	.261	6.5	.077	.77	7053	425									
125	50	468.0	5.0	.4	.545	13.6	.264	6.6	.062	.62	7052	400									
130	55	467.6	4.6	.4	.571	14.2	.236	5.9	.065	.65	7053	400									
135	1500	467.2	4.2	.4	.544	13.6	.255	6.4	.086	.86	7052	425									
140	05	466.8	3.8	.4	.535	13.3	.266	6.6	.081	.81	7052	425									
145	10	466.4	3.4	.4	.538	13.4	.266	6.6	.074	.74	7051	425									
150	15	466.0	3.0	.4	.518	12.9	.289	7.2	.066	.66	7051	425									
155	20	465.7	2.7	.3	.462	11.5	.355	8.9	.042	.42	7050	400									
160	25	465.5	2.5	.2	.445	11.1	.367	9.2	.053	.53	7049	425									
165	30	465.3	2.3	.2	.347	8.7	.445	11.1	.105	1.06	7047	475									
170	35	465.1	2.1	.2	.312	7.8	.470	11.7	.130	1.31	7045	475									
175	40	465.0	2.0	.1	.297	7.4	.474	11.8	.156	1.57	7045	475									
SUBTOTAL											*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
TOTAL											*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****

100

[illegible]

RUN 4

COUNTRY STOVES, INC. - S210

10/16/2003

TEMPERATURE DATA SHEET #14

		TEST TIME	330		
STACK AVG	215	TOP AVG	232	LT SIDE AVG	317
BACK AVG	227	RT SIDE AVG	331	BOTTOM AVG	258
FIREBOX AVG #####		SEC/CAT AVG	864	AMBIENT AVG	80

END	232.6	
START	313.9	
	-81.3	DELTA T

CIRCLE: LOSS / GAIN

Time	Stack	Top	LT Side	Back	Rt Side	Bottom	Firebox	Sec/Cat	Ambient	Tube Furn	Smpl Box	Smpl Out	C-Gas Box	C-Gas Out	SO2 Out
180	215	260	356	263	376	239	#####	898	79	1329	237	50	248	37	35
185	211	252	352	265	373	241	#####	887	79	1330	237	50	248	37	35
190	208	246	348	268	370	243	#####	873	79	1331	237	50	248	37	35
195	205	240	345	271	368	245	#####	865	78	1332	237	51	248	37	35
200	203	235	341	274	367	246	#####	847	78	1330	237	52	248	37	34
205	200	230	339	275	365	248	#####	832	77	1328	237	52	248	37	34
210	198	225	335	274	366	249	#####	819	78	1327	237	52	248	36	34
215	196	221	333	273	363	251	#####	806	77	1325	237	53	247	36	34
220	192	219	332	273	363	253	#####	788	80	1324	237	53	248	36	34
225	193	217	330	273	361	255	#####	803	79	1322	238	54	248	36	34
230	189	214	327	272	359	256	#####	778	80	1321	238	53	248	36	33
235	187	211	324	267	356	258	#####	760	81	1320	238	53	248	35	34
240	185	208	321	262	352	259	#####	745	81	1319	238	53	248	35	34
245	183	206	317	258	348	260	#####	727	81	1319	238	54	248	35	35
250	181	203	314	254	343	260	#####	715	81	1319	238	56	249	36	35
255	180	200	309	250	340	261	#####	697	81	1320	238	56	248	35	37
260	178	196	305	244	334	260	#####	687	81	1322	237	56	247	34	37
265	176	193	301	239	330	260	#####	677	80	1323	237	56	247	34	37
270	175	191	297	234	326	259	#####	666	80	1324	237	57	246	34	37
275	174	189	293	233	321	259	#####	657	83	1325	237	57	247	34	37
280	173	187	291	231	317	258	#####	649	83	1325	236	57	246	34	36
285	172	186	288	231	314	257	#####	645	84	1325	236	57	246	34	36
290	172	184	287	227	311	256	#####	644	84	1325	236	58	246	35	36
295	171	183	286	225	307	255	#####	642	85	1324	236	58	246	35	36
300	171	182	285	225	305	254	#####	636	84	1324	236	58	245	35	36
305	170	180	283	221	301	253	#####	630	80	1329	237	60	248	35	36
310	168	177	281	217	298	251	#####	617	79	1334	238	60	249	34	36
315	166	175	278	213	293	249	#####	604	79	1337	238	61	248	35	35
320	164	172	275	209	288	248	#####	595	78	1337	237	59	249	35	35
325	162	170	271	206	285	246	#####	604	77	1337	236	59	248	35	35
330	161	168	267	202	280	245	#####	595	77	1335	236	59	247	36	35

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 10/16/03 Analyte : CO₂ (15-1)
 Unit : COUNTY STOVES - 8210 Run # : 4
 Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % CO₂ Cyl. Press. : 480 PSI
 Certified by : AIR LIQUIDE Date : 02-20-02
 Span Cyl. # : CC-3131 Conc. : 12.40 % CO₂ Cyl. Press. : 1025 PSI
 Certified by : AIR LIQUIDE Date : 03-13-03
 Analyzer : Make : HORIBA Model : PIR-2000 SN : 407069
 Range : 0 - 25.0 % CO₂ Analyzer Output : 0 - 1.0 v.
 Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % CO₂
 EPA Control Limits = $\pm 2.5\%$ of 25.0 % CO₂ = $\pm 0.625\%$ CO₂
 Method 28 A = $\pm .2\%$ of 25.0 % CO₂ = $\pm .05\%$ CO₂

PRE RUN Audit : by : D. Wadsworth Time : 1130 Temp : 85 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	.012	+012	+049
SPAN	49.6	.496	12.40	49.7	.497	12.397	-003	-012

POST RUN Audit : by : D. Wadsworth Time : 1835 Temp : 76 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	7013	-013	-051
SPAN	49.6	.496	12.40	49.7	.497	12.397	-003	-012

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

ZERO / SPAN CHECK DATA SHEET #15-2

Date : 10/16/03 Analyte : O₂ (15-2)
 Unit : COUNTRY STOVES-S210 Run # : 4
 Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % O₂ Cyl. Press. : 480 PSI
 Certified by : AIR LIQUIDE Date : 02-20-02
 Span Cyl. # : CC-3131 Conc. : 12.40 % O₂ Cyl. Press. : 1025 PSI
 Certified by : AIR LIQUIDE Date : 03-13-03
 Analyzer : Make : TELEDYNE Model : 320 A SN : 37400
 Range : 0 - 25.0 % O₂ Analyzer Output : 0 - 1.0 v.
 Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % O₂
 EPA Control Limits = $\pm 2.5\%$ of 25.0 % O₂ = $\pm 0.625 % O_2$
 Method 28 A = $\pm .2\%$ of 25.0 % O₂ = $\pm .05 % O_2$

PRE RUN Audit : by : D. Washington Time : 1130 Temp : 85 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.000	.000	±.001
SPAN	12.50	.500	12.50	12.50	.501	12.501	±.001	±.006

POST RUN Audit : by : D. Washington Time : 1835 Temp : 76 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	.025	±.025	±.101
SPAN	12.50	.500	12.50	12.55	.502	12.526	±.026	±.105

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

ZERO / SPAN CHECK DATA SHEET #15-3

Date : 10/16/03 Analyte : CO (15-3)
 Unit : COUNTRY STOVES - 8210 Run # : 4
 Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % CO Cyl. Press. : 480 PSI
 Certified by : AIR LIQUIDE Date : 02-20-02
 Span Cyl. # : CC-3131 Conc. : 12.40 % CO Cyl. Press. : 1025 PSI
 Certified by : AIR LIQUIDE Date : 03-13-03
 Analyzer : Make : HORIBA Model : PIR-2000 SN : 408005
 Range : 0 - 10.0 % CO Analyzer Output : 0 - 1.0 v.
 Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 10.0 % CO
 EPA Control Limits = $\pm 2.5\%$ of 10.0 % CO = ± 0.25 % CO
 Method 28 A = $\pm .2$ % of 10.0 % CO = $\pm .02$ % CO

PRE RUN Audit : by : D. Wadsworth Time : 1130 Temp : 85 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	.011	+0.011	+1.13
SPAN	50.2	.502	5.02	50.2	.502	5.039	+0.019	+1.90

POST RUN Audit : by : D. Wadsworth Time : 1835 Temp : 76 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	-.009	-.009	-.088
SPAN	50.2	.502	5.02	50.1	.501	5.029	+0.009	+.090

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

ZERO / SPAN CHECK DATA SHEET #15-4

Date : 10/16/03 Analyte : SO₂ (15-4)
 Unit : COUNTRY STOVES-S210 Run # : 4
 Zero Cyl. # : 042TAC 2-A Conc. : 0.00 ppm SO₂ Cyl. Press. : 480 PSI
 Certified by : AIR LIQUIDE Date : 02-20-02
 Span Cyl. # : CC62184 Conc. : 1290 ppm SO₂ Cyl. Press. : 850 PSI
 Certified by : AIR LIQUIDE Date : 01-29-01
 Analyzer : Make : HORIBA Model : PIR-2000 SN : 403019
 Range : 0 - 2500 ppm SO₂ Analyzer Output : 0 - 1.0 v.
 Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO₂
 EPA Control Limits = $\pm 2.5\%$ of 2500 ppm SO₂ = ± 62.5 ppm SO₂

PRE RUN Audit : by : D. Wadsworth Time : 1130 Temp : 85 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	4.607	+4.607	+184
SPAN	51.6	.516	1290	51.8	.518	1290.788	+1.788	+0.32

POST RUN Audit : by : D. Wadsworth Time : 1835 Temp : 76 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	-1.368	-1.368	-0.15
SPAN	51.6	.516	1290	51.7	.517	1288.301	-1.699	-0.68

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

QUALITY CHECKS DATA SHEET # 16

UNIT: COUNTRY STOVES-S210 RUN: 4 DATE: 10/16/03

Thermocouple Check:

T/C # 1	<u> </u>	°F	T/C # 13	<u>71.4</u>	°F
T/C # 2	<u> </u>	°F	T/C # 14	<u>68.6</u>	°F
T/C # 3	<u>68.8</u>	°F	T/C # 15	<u>72.0</u>	°F
T/C # 4	<u>66.8</u>	°F	T/C # 16	<u>52.1</u>	°F
T/C # 5	<u>66.4</u>	°F	T/C # 17	<u>51.8</u>	°F
T/C # 6	<u>66.5</u>	°F	T/C # 18	<u>72.6</u>	°F
T/C # 7	<u>66.4</u>	°F	T/C # 19	<u>68.2</u>	°F
T/C # 8	<u>65.9</u>	°F	T/C # 20	<u> </u>	°F
T/C # 9	<u> </u>	°F	T/C # 21	<u> </u>	°F
T/C # 10	<u>67.5</u>	°F	T/C # 22	<u> </u>	°F
T/C # 11	<u>63.4</u>	°F	T/C # 23	<u> </u>	°F
T/C # 12	<u>75.9</u>	°F	T/C # 24	<u> </u>	°F

Thermocouple Readout:

Pretest zero and span check and calibration

post test zero and span

% difference

ZERO - .8 °F Adj. to 0.0 °F

ZERO 1.2 °F

Difference .060 %

SPAN 2004.0 °F Adj. to 2000.0 °F

SPAN 2001.0 °F

Difference .050 %

Thermocouple Readout Pretest Linearity Check:

0	=	<u>0.0</u>	°F	200	=	<u>200.3</u>	°F	400	=	<u>400.1</u>	°F
600	=	<u>600.0</u>	°F	800	=	<u>799.9</u>	°F	1000	=	<u>999.8</u>	°F
1200	=	<u>1199.8</u>	°F	1400	=	<u>1399.6</u>	°F	1600	=	<u>1599.6</u>	°F
1800	=	<u>1799.8</u>	°F	2000	=	<u>2000.0</u>	°F				

Sample Train Leak Check

Pre

✓

Post

✓

C-gas Train Leak Check

Pre

✓

Post

✓

SO₂ Train Leak Check

Pre

✓

Post

✓

Static Gauge Zero Check

Pre

✓

Post

✓

Scale Check Pre :

474.7 - 464.7

Post :

472.4 - 462.4

Stack Cleaned Prior to Test Run : YES

NO

X

M 70 1.25'

COMPUTER INPUT DATA SHEET #1

Client: COUNTRY STOVES, INC.
 Address: 1502 14TH STREET NW
AUBURN, WA 98001
 Phone: 253-735-1100 Fax: 253-931-1271
 Run No.: 2 Date of Test: 10/14/03 Burn Rate: 1.063 ✓
 Model No.: S210 ☐ min ☒ min-1.25 ☐ fan-
 Stove Type: ☐ Cat ☒ Non Cat ☐ Pellet ☐ 1.25-1.9 ☐ max ☐ insert-
 Dry Gas Meter Y Factor: .981 ✓ (0.000) (Data Sheet #2) Post Leak Rate: .001 ✓ cfm (0.000) (Data Sheet #2) Time: 310 ✓ min. (000) (Data Sheet #2)
 Dry Gas Meter Volume: 94.503 ✓ cf
 Stack Flow: 7.437 ✓ dscfm ΔH : .145 ✓ in. H₂O (00.000) (Data Sheet #2)
 Maximum Vac.: 5.0 ✓ (0.0) (Data Sheet #2) Barometric Pressure: 30.20 ✓ in. Hg (00.00) (Data Sheet #2)
 H₂O Captured: 144.2 ✓ g (00.0) (Data Sheet #3)
 Front Half Catch % Of Total: 37.1 ✓ % Total Particulate Catch: .9377 ✓ g (00.0) (Data Sheet #6) (0.0000) (Data Sheet #6)
 Flue Gas Moisture: 7.0253 ✓ % (00.000) (Data Sheet #7)
 Particulate Emission: .1611 ✓ gr/dscf (0.0000) (Data Sheet #7)
 Relative Humidity: 39.0 ✓ % RH Ambient Moisture: 1.40 ✓ % H₂O (00.0) (Data Sheet #8) (0.00) (Data Sheet #8)
 Preburn Fuel Wt.: 46.1 ✓ lbs. Coal Bed Wt.: 3.5 ✓ lbs. Test Fuel Wt.: 14.7 ✓ lbs. (00.0) (Data Sheet #8) (00.0) (Data sheet #8) (00.0) (Data sheet #8)
 Heat Output (EPA Default): 12,823.5 ✓ BTU/hr (00,000.0) (Data Sheet #8)
 Kindling Fuel % Moisture (wet): 11.765 ✓ % Pretest Fuel % Moisture (wet): 17.898 ✓ % (00.000) (Data Sheet #10) (00.000) (Data Sheet #10)
 Test Fuel % Moisture (dry): 21.353 ✓ % Test Fuel % Moisture (wet): 17.596 ✓ % (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: -.034 ✓ in. H₂O (+/- .000) (Data Sheet #12)
 Average Ambient Temperature: 78 ✓ °F Stove Temperature Change: -80.5 ✓ °F (00) (Data Sheet #14) (+/- 000.0) (Data Sheet #14)

TABLE 1 ----- RAW DATA

CLIENT : Country Stoves, Inc.

TEST No. : 2

MODEL: S210

DATE: 14-Oct-03

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	575.500	0.150	86	1.54	5.50	450
5	577.000	0.500	86	0.49	9.70	250
10	579.762	0.150	86	0.64	5.20	450
15	581.299	0.140	86	0.75	5.40	475
20	582.755	0.140	86	0.90	6.90	475
25	584.212	0.140	86	0.91	9.00	475
30	585.668	0.150	86	0.90	15.60	450
35	587.205	0.170	86	0.56	12.30	425
40	588.832	0.170	86	0.35	11.90	425
45	590.460	0.170	88	0.46	10.50	425
50	592.099	0.170	88	0.61	9.80	425
55	593.738	0.150	88	0.99	8.50	450
60	595.287	0.150	89	0.94	8.60	450
65	596.841	0.150	89	0.83	8.70	450
70	598.395	0.150	89	0.69	11.40	450
75	599.949	0.170	89	0.46	12.70	425
80	601.594	0.190	89	0.27	13.20	400
85	603.342	0.190	89	0.44	12.80	400
90	605.090	0.190	89	0.64	11.10	400
95	606.838	0.190	89	0.63	10.30	400
100	608.586	0.190	89	0.49	11.00	400
105	610.334	0.170	90	0.42	11.30	425
110	611.985	0.170	90	0.61	8.90	425
115	613.636	0.130	90	1.34	7.00	475
120	615.114	0.120	91	1.32	7.10	500
125	616.523	0.130	91	1.20	7.20	475
130	618.006	0.130	91	0.87	9.30	475
135	619.490	0.130	91	0.82	10.80	475
140	620.973	0.170	91	0.54	10.20	425
145	622.630	0.150	92	0.64	8.70	450
150	624.201	0.120	92	0.94	7.60	500
155	625.615	0.110	92	1.13	6.60	525
160	626.962	0.100	92	1.17	6.30	550
165	628.248	0.100	92	1.15	6.30	550
170	629.534	0.100	92	1.10	6.40	550
175	630.819	0.110	92	1.19	6.40	525
180	632.166	0.110	92	1.15	6.60	525
185	633.513	0.110	92	1.14	6.90	525
190	634.866	0.110	92	1.29	6.70	525
195	636.207	0.110	92	1.22	6.90	525
200	637.554	0.120	92	1.27	6.90	500
205	638.968	0.120	92	1.25	6.90	500
210	640.382	0.120	92	1.32	7.00	500
215	641.796	0.130	92	1.35	6.90	475

220	643.285	0.130	92	1.41	7.00	475
225	644.773	0.130	92	1.48	6.90	475
230	646.262	0.130	92	1.53	6.90	475
235	647.750	0.130	92	1.53	6.90	475
240	649.239	0.130	91	1.55	6.80	475
245	650.722	0.130	91	1.56	6.80	475
250	652.205	0.130	91	1.73	6.60	475
255	653.688	0.130	91	1.88	6.40	475
260	655.171	0.130	91	2.07	6.20	475
265	656.655	0.130	91	2.11	6.10	475
270	658.138	0.130	91	1.65	5.90	475
275	659.621	0.130	91	0.59	5.90	475
280	661.104	0.130	91	1.58	5.90	475
285	662.587	0.130	91	1.69	5.80	475
290	664.070	0.130	91	1.75	5.70	475
295	665.553	0.130	91	1.63	5.40	475
300	667.036	0.130	91	1.63	5.20	475
305	668.520	0.130	91	1.65	5.20	475
310	670.003	0.130	91	1.62	5.20	475
315						

TABLE 2---RAW DATA

CLIENT : Country Stoves, Inc.

TEST No. 2

MODEL: S210

DATE: 14-Oct-03

METER CAL.		Wt. WOOD		
FACTOR (Y)	----- 0.981	BURNED (LB)	----- 14.7	Lbs

BAROMETRIC		WET, FUEL		
PRESS. (Pb)	----- 30.2 in Hg	MOISTURE %	----- 17.596	%

LEAK RATE		Wt. PART.		
POST (Lp)	----- 0.001 cfm	COLLECTED	----- 0.9377	g

WATER		METER		
VOL. (V1c)	----- 144.2 Ml	VOLUME Vm	----- 94.503	mcf

TEST		HC MOLE		
TIME (MIN)	----- 310 min	FRACTION	----- 0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT :Country Stoves, Inc.

TEST No. 2

MODEL: S210

DATE: 14-Oct-03

AVG DELTA		AVG PRCNT		
H	----- 0.12 in H2O	CO	----- 1.10	%

AVG METER		AVG PRCNT		
TEMP. Tm	----- 90 deg F	CO2	----- 7.97	%

AVG PPM		AVG BAL		
SO2	----- 466 PPM	CO2/CO	----- 7.21	%

TABLE 4 ----- CALCULATIONS

CLIENT : Country Stoves, Inc.

TEST No. 2

MODEL: S210

DATE: 14-Oct-03

STD SAMPLE		STACK GAS		
VOL. Vm(std) -----	89.86 dscf	FLOW Qsd -----	368.559	dscf/Hr
			6.14	& dscf/min
VOL. WATER		PARTICULATE		
VAPOR Vw(std) -----	6.787 scf	CONCTRT. Cs -----	0.0104	g/dscf
PRCNT		PARTC. EMISS.		
MSTR Bws -----	7.02 %	RATE E -----	3.85	g/Hr
BURN		MOLES OF GAS		
RATE BR -----	1.06 Kg/Hr	PER Lb WOOD Nt --	0.41	Lb-mole/Lb
CO EMISSION		PART. EMISS.		
RATE -----	136.28 g/Hr	RATE -----	3.62	g/Kgdry
	&			fuel
	128.20 g/Kgdry			
	fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Country Stoves, Inc.

TEST No. : 2

MODEL: S210

DATE: 14-Oct-03

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
=====	=====	=====	=====
5	646.6	97	100
10	661.5	99	
15	662.6	99	
20	662.6	99	
25	663.1	99	
30	662.6	99	
35	662.6	99	
40	662.4	99	
45	661.6	99	
50	664.8	100	
55	664.8	100	
60	664.7	100	
65	666.2	100	
70	666.2	100	
75	666.2	100	
80	666.1	100	
85	666.2	100	
90	666.2	100	
95	666.2	100	
100	666.2	100	
105	665.6	100	
110	667.3	100	
115	667.3	100	
120	667.1	100	
125	668.8	100	
130	668.7	100	
135	669.2	100	
140	668.7	100	
145	667.9	100	
150	669.9	100	
155	669.9	100	
160	670.1	100	
165	670.2	100	
170	670.2	100	
175	669.7	100	
180	670.1	100	
185	670.1	100	
190	673.1	101	
195	667.1	100	
200	669.9	100	
205	669.7	100	
210	669.7	100	
215	669.7	100	
220	670.0	100	

225	669.5	100
230	670.0	100
235	669.5	100
240	670.6	101
245	668.5	100
250	668.5	100
255	668.5	100
260	668.5	100
265	669.0	100
270	668.5	100
275	668.5	100
280	668.5	100
285	668.5	100
290	668.5	100
295	668.5	100
300	668.5	100
305	669.0	100
310	668.5	100
315		
320		

METER BOX DATA SHEET PAGE # 2

Page: 1 of 3UNIT: COUNTRY STORES - S210 RUN: 2 DATE: 10/14/03Meter Box: 5H Y Factor: .981 ✓Leak checks: 15 " Hg @ .000 cfm _____ " Hg @ _____ cfm15 " Hg @ 100 ✓ cfm _____ " Hg @ _____ cfmInject SO₂ @ 100 cc/min.

Nozzle: Probe @ 3/8" od

Initial Volume: 1.500

ROTO: PRESS: <u>.16</u>		SAMPLING RATIO: <u>25</u> : 1					BP: <u>30.20</u>		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1210	575.500	—	7.664	.15	86	450	86	1.0
5	15	577.000	—	13.796	.50	86	250	86	3.0
10	20	579.762	579.762	7.664	.15	86	450	86	1.0
15	25	581.299	581.299	7.261	.14	86	475	86	1.0
20	30	582.755	582.755	7.261	.14	86	475	86	3.0
25	35	584.212	584.212	7.261	.14	86	475	86	4.0
30	40	585.668	585.668	7.664	.15	86	450	86	5.0
35	45	587.205	587.205	8.115	.17	86	425	86	5.0
40	50	588.832	588.832	8.115	.17	86	425	86	5.0
45	55	590.460	590.460	8.086	.17	88	425	88	5.0
50	1300	592.099	592.099	8.086	.17	88	425	88	5.0
55	05	593.738	593.738	7.636	.15	88	450	88	5.0
ROTO PRESS: <u>.16</u>		TOTALS:		98.609	2.20	1038	BP: 30.20		
60	1310	595.287	595.287	7.622	.15	89	450	89	5.0
65	15	596.841	596.841	7.622	.15	89	450	89	5.0
70	20	598.395	598.395	7.622	.15	89	450	89	5.0
75	25	599.949	599.949	8.071	.17	89	425	89	5.0
80	30	601.594	601.594	8.575	.19	89	400	89	5.0
85	35	603.342	603.342	8.575	.19	89	400	89	5.0
90	40	605.090	605.090	8.575	.19	89	400	89	5.0
95	45	606.838	606.838	8.575	.19	89	400	89	5.0
100	50	608.586	608.586	8.575	.19	89	400	89	5.0
105	55	610.334	610.334	8.056	.17	90	425	90	5.0
110	1400	611.985	611.985	8.056	.17	90	425	90	5.0
115	05	613.636	613.636	7.208	.13	90	475	90	5.0
		TOTALS:		97.132	2.04	1071	MAX VACC =		
TOTAL Cu Ft		TOTALS:		195.741	4.24	2109	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 3

UNIT: Country Stoves 5-210 RUN: 2 DATE: 10-14-03

Meter Box: 5H Y Factor: .981 ✓

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

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

Inject SO₂ @ 100 cc/min. Nozzle: Probe @ 3/8" od Initial Volume: 1.500

ROTO: PRESS: .16			SAMPLING RATIO: 25			: 1		BP: 30.20		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC	
120	1410	615.114	615.114	6.835	.12	91	500	91	4.0	
125	15	616.523	616.523	7.195	.13	91	475	91	4.0	
130	20	618.006	618.006	7.195	.13	91	475	91	4.0	
135	25	619.490	619.490	7.195	.13	91	475	91	4.0	
140	30	620.973	620.973	8.041	.17	91	425	91	4.0	
145	35	622.630	622.630	7.581	.15	92	450	92	4.0	
150	40	624.201	624.201	6.823	.12	92	500	92	4.0	
155	45	625.615	625.615	6.498	.11	92	525	92	4.0	
160	50	626.962	626.962	6.203	.10	92	550	92	4.0	
165	55	628.248	628.248	6.203	.10	92	550	92	4.0	
170	1500	629.534	629.534	6.203	.10	92	550	92	4.0	
175	05	630.819	630.819	6.498	.11	92	525	92	4.0	
ROTO PRESS: .16			TOTALS: 82.470		1.47	1099	BP: 30.20			
180	1510	632.166	632.166	6.498	.11	92	525	92	4.0	
185	15	633.513	633.513	6.498	.11	92	525	92	4.0	
190	20	634.866	634.866	6.498	.11	92	525	92	4.0	
195	25	636.207	636.207	6.498	.11	92	525	92	4.0	
200	30	637.554	637.554	6.823	.12	92	500	92	4.0	
205	35	638.968	638.968	6.823	.12	92	500	92	4.0	
210	40	640.382	640.382	6.823	.12	92	500	92	4.0	
215	45	641.796	641.796	7.182	.13	92	475	92	4.0	
220	50	643.285	643.285	7.182	.13	92	475	92	4.0	
225	55	644.773	644.773	7.182	.13	92	475	92	4.0	
230	1600	646.262	646.262	7.182	.13	92	475	92	4.0	
235	05	647.750	647.750	7.182	.13	92	475	92	4.0	
			TOTALS: 82.371		1.45	1104	MAX VACC =			
TOTAL Cu Ft.			TOTALS: 164.841		2.92	2203	AVG. BP:			

METER BOX DATA SHEET PAGE # 2

Page: 3 of 3

UNIT: Country Stores S210 RUN: 2

DATE: 10-14-03

Meter Box: 5H Y Factor: .981 ✓

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

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

Inject SO₂ @ 100 cc/min.

Nozzle: Probe @ 3/8" od

Initial Volume: 1500

ROTO: PRESS: <u>.16</u>			SAMPLING RATIO: <u>25</u> : 1			BP: <u>30.20</u>			
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1610	649.239	649.239	7.195	.13	91	475	91	4.0
245	15	650.722	650.722	7.195	.13	91	475	91	4.0
250	20	652.205	652.205	7.195	.13	91	475	91	4.0
255	25	653.688	653.688	7.195	.13	91	475	91	4.0
260	30	655.171	655.171	7.195	.13	91	475	91	4.0
265	35	656.653	656.653	7.195	.13	91	475	91	4.0
270	40	658.138	658.138	7.195	.13	91	475	91	4.0
275	45	659.621	659.621	7.195	.13	91	475	91	4.0
280	50	661.104	661.104	7.195	.13	91	475	91	4.0
285	55	662.587	662.587	7.195	.13	91	475	91	4.0
290	1700	664.070	664.070	7.195	.13	91	475	91	4.0
295	05	665.553	665.553	7.195	.13	91	475	91	4.0
ROTO PRESS: <u>.16</u>			TOTALS: <u>86.340</u>			<u>1.56</u>	<u>1092</u>	BP: <u>30.20</u>	
300	1710	667.036	667.036	7.195	.13	91	475	91	4.0
305	15	668.520	668.520	7.195	.13	91	475	91	4.0
310	20	670.003	670.003	7.195	.13	91	475	91	4.0
315	25								
320	30			21.585	.39	273			
325	35			107.925	1.95	1365			
330	40								
335	45								
340									
345									
350									
355						567	163	✓	
			TOTALS: <u>468.507</u>	<u>9.11</u>	<u>90</u>	MAX VACC = <u>5.0</u>			
TOTAL Cu Fl <u>94.503</u>			TOTALS: <u>7.437</u>	<u>.145</u>	<u>(550)</u>	AVG. BP: <u>30.20</u>			

PARTICULATE CATCH / MOISTURE DATA SHEET

UNIT: COUNTRY STOVES-S21A RUN: 2 DATE: 10/14/03

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

SCALE	WEIGHT
295.0 g	295.0
590.0 g	590.0
885.0 g	885.0

IMPINGER	#1	#2	#3	#4
FINAL WT	715.9	596.0	488.2	878.6
INITIAL WT	620.3	590.0	483.5	840.7
NET WT GRAMS	95.6	6.0	4.7	37.9

TOTAL CATCH: 144.2 GRAMS H₂O

FRONT HALF

FILTER #	176F	
FINAL WT g	.8974	✓
INITIAL WT g	.6972	✓
NET WT g	.2002	✓

BEAKER #	131
DESC.	ACETONE
FINAL WT g	106.9957
INITIAL WT g	106.8475
NET WT g	.1482
VOL. DESC. ml	75

BACK HALF

FILTER #	176B	
FINAL WT g	.4885	✓
INITIAL WT g	.4239	✓
NET WT g	.0646	✓

BEAKER #	132	133	134	135	
DESC.	ACETONE	METHCHLOR	H ₂ O	H ₂ O	
FINAL WT g	105.6826	106.5707	107.7625	104.6977	
INITIAL WT g	105.3862	106.5067	107.6926	104.5958	
NET WT g	.2964	.0640	.0699	.1019	.1718
VOL. DESC ml	150	75	150	190	(340)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : _____ Date : 05/12/2003 Time : 1215 By : DKW
 Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : ZB921
 Back Size: 8.2 cm Lot No. : ZB911

DATE: <u>05-15-03</u>		BY: <u>DKW</u>		DATE: <u>05-16-03</u>		BY: <u>DKW</u>		DATE: _____		BY: _____	
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME					
171F	.6931	1133	(.6931)	0942	HEARTHSTONE-TRIP R-2						
172F	.6967	1134	(.6966)	0943	"	"	R-3				
173F	.6934	1135	(.6935)	0944	"	"	R-4				
174F	.6998	1136	(.6997)	0945	"	"	R-5				
175F	.6955	1137	(.6955)	0946	COUNTRY STOVES-S210 R#1						
176F	.6973	1137	(.6972)	0946	"	"	R-2				
177F	.6943	1138	(.6941)	0947	"	"	R-3				
178F	.6911	1139	(.6912)	0948	"	"	R-4				
179F	.6963	1140	(.6964)	0949							
180F	.6931	1141	(.6931)	0950							

171B	.4319	1151	(.4320)	0958	HEARTHSTONE-TRIP	R-2
172B	.4326	1151	(.4325)	0959	" "	R-3
173B	.4259	1152	(.4260)	1000	" "	R-4
174B	.4310	1153	(.4307)	1001	" "	R-5
175B	.4282	1154	(.4284)	1001	COUNTRY STOVES-S210	R#1
176B	.4238	1155	(.4239)	1002	" "	R-2
177B	.4311	1156	(.4309)	1003	" "	R-3
178B	.4351	1157	(.4350)	1004	" "	R-4
179B	.4299	1158	(.4300)	1005		
180B	.4311	1158	(.4309)	1005		

Checked by: C. W. Wainwright Date: 5-16-03 Time: 1241

SCALE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	DB	% RH
05-15	1120	DKW	78	46
05-16	0930	DKW	73	45

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: ⁰⁹ Date: ⁰⁹ 18/2003 Time: 0900 By: DKW

BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
126	105.7690	0838	105.7694	1013		
127	104.0768	0839	104.0771	1014	COUNTRY STONES-S210 R#1	
128	105.6108	0840	105.6109	1015		
129	106.4315	0841	106.4320	1016		
130	106.5054	0843	106.5058	1018		
131	106.8471	0844	106.8475	1019		
132	105.3860	0845	105.3862	1020	COUNTRY STONES-S210 R#2	
133	106.5070	0846	106.5067	1021		
134	107.6923	0847	107.6926	1023		
135	104.5961	0848	104.5958	1024		
136	107.0835	0849	107.0840	1025		
137	104.1653	0850	104.1651	1027	COUNTRY STONES-S210 R#3	
138	105.2454	0851	105.2450	1028		
139	104.4051	0852	104.4055	1029		
140	106.9637	0853	106.9640	1031		
141	102.2830	0854	102.2833	1032		
142	107.8136	0855	107.8140	1033	COUNTRY STONES-S210 R#4	
143	105.5725	0856	105.5723	1035		
144	106.3813	0857	106.3817	1036		
145	101.5218	0858	101.5221	1037		
146	101.3692	0859	101.3694	1039		
147	106.9572	0860	106.9574	1040		
148	104.7573	0861	104.7577	1041		
149	107.5469	0862	107.5472	1042		
150	106.7053	0863	106.7055	1044		

SCALE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	DB	% RH	Checked by:
09/24	0835	DKW	75	47	Chp Winkler
09/25	1010	DKW	76	49	
					Time: 1150

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT: COUNTRY STOVES - S210

RUN: 2

DATE: 10/14/03

Page: 1

of 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
131	10/15	2125	R	106.9957	10/17	1610	R	(106.9957)	10/19	1220	R
132	10/15	2125	R	105.6830	10/17	1611	R	(105.6826)	10/19	1221	R
133	10/16	1130	R	106.5732	10/17	1612	R	106.5722	10/19	1222	R
134	10/15	2125	R	(106.5707)	10/21	1323	R	(107.7625)	10/19	1224	R
135	10/15	2125	R	107.7626	10/17	1613	R	(104.6977)	10/19	1225	R

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
176F	10/14	1800	CP	.8977	10/15	2116	R	(.8974)	10/17	1615	R
176B	10/14	1800	CP	.4930	10/15	2117	R	.4897	10/17	1616	R
				(.4885)	10/20	1525	R	.4888	10/19	1226	R

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	10/15	2105	R	77	49
2	10/17	1600	R	78	48
3	10/19	1210	R	78	48
4	10/20	1520	R	78	49
5	10/21	1320	R	78	49

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 02-24-2003 Through 06-18-2003	Scale: Sartorius	Model: A 120 S	SN: 37010004
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100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9998	10.000	1.0000	.0999	AKL	02-24	1055	74	44
99.9997	9.9998	1.0001	.0999	AKL	02-25	1700	77	45
100.0000	10.0001	1.0000	.0998	AKL	03-01	1010	71	44
99.9997	10.0001	.9998	.0999	AKL	03-02	1420	75	45
99.9998	10.0000	.9999	.1000	AKL	03-03	1205	76	45
99.9998	10.0000	1.0000	.1000	AKL	03-03	2005	77	47
100.0000	10.0001	1.0001	.0999	AKL	03-04	1035	75	47
99.9996	10.0001	1.0000	.0999	AKL	03-05	0945	71	47
99.9997	10.0001	1.0000	.1000	AKL	03-06	1340	74	46
99.9998	9.9999	1.0000	.0998	AKL	03-07	2050	76	45
99.9998	9.9999	1.0000	.0999	AKL	03-08	1150	77	45
99.9997	9.9998	1.0000	.1000	AKL	03-09	1350	76	45
99.9998	10.0000	.9999	.1000	AKL	03-10	1220	77	47
99.9997	9.9999	1.0000	.1000	AKL	03-18	1740	77	46
99.9997	9.9999	1.0000	.0999	AKL	03-20	2145	74	45
99.9998	10.0000	1.0000	.0998	AKL	03-22	1725	76	47
99.9997	10.0000	.9999	.1000	AKL	03-23	1405	77	47
99.9998	9.9998	.9999	.0999	AKL	03-24	1450	74	44
100.0000	9.9998	1.0000	.0998	AKL	03-25	1120	75	45
99.9998	10.0000	.9999	.0999	AKL	04-30	2300	75	47
99.9997	10.0001	.9999	.1000	AKL	05-02	1130	77	49
99.9998	9.9998	1.0000	.0999	AKL	05-06	2135	77	46
99.9997	9.9999	1.0001	.0999	AKL	05-09	0715	77	45
99.9998	10.0000	.9999	.0999	AKL	05-10	1435	78	47
99.9998	9.9999	1.0000	.0998	AKL	05-11	1210	77	46
99.9999	10.0001	.9999	.0999	AKL	05-12	0940	76	45
10.0001	10.0000	.9999	.1000	AKL	05-13	0910	77	46
99.9999	10.0001	1.0000	.0999	AKL	05-15	1120	78	46
99.9997	9.9999	1.0000	.0999	AKL	05-16	0930	73	45
100.0001	10.0000	.9999	.0999	AKL	05-17	1105	74	46
100.0000	9.9999	1.0000	.1000	AKL	05-18	1550	77	48
99.9997	10.0000	.9999	.0999	AKL	06-04	1025	76	46
99.9998	9.9999	1.0000	.0999	AKL	06-06	1035	78	49
99.9998	9.9999	1.0000	.0999	AKL	06-12	0950	73	43
99.9997	10.0002	1.0000	.0998	AKL	06-13	2115	78	46
99.9998	10.0000	1.0000	.0999	AKL	06-14	1110	78	46
99.9997	9.9999	1.0000	.1000	AKL	06-15	1110	78	47
99.9998	10.0001	1.0000	.1001	AKL	06-17	0905	78	48
99.9998	10.0000	.9999	.1000	AKL	06-18	1025	78	47

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 06-19-2003 Through 10-20-2003	Scale: Sartorius	Model: A 120 S	SN: 37010004
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100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0000	0.9999	.1001	BW	06/19	0955	77	48
100.0000	10.0000	1.0000	.0999	BW	06/19	1040	75	48
99.9998	9.9998	1.0000	.0999	BW	07/23	0840	78	47
99.9997	9.9998	.9999	.0998	BW	07/24	2200	78	48
99.9997	9.9999	.9999	.0997	BW	07/25	0845	76	47
99.9999	10.0001	1.0000	.0999	BW	07/26	1040	78	49
99.9997	9.9998	1.0000	.0998	BW	07/27	1135	77	48
99.9999	10.0000	1.0000	.0999	BW	07/29	2015	78	48
99.9997	9.9999	.9999	.0999	BW	07/30	2100	77	48
99.9998	9.9998	.9999	.0999	BW	08/01	1205	77	47
100.0000	10.0000	.9999	.0998	BW	08/28	0915	74	49
99.9999	10.0000	1.0000	.0997	BW	08/29	0715	78	46
99.9997	10.0001	.9998	.0997	BW	09/02	0930	77	48
99.9997	10.0000	.9999	.0999	BW	09/03	0815	77	48
99.9999	9.9999	1.0000	.1000	BW	09/04	0855	78	49
99.9998	9.9999	1.0000	.0999	BW	09/05	1110	78	48
99.9997	10.0000	.9998	.0998	BW	09/06	1940	78	49
99.9997	9.9999	1.0000	.1000	BW	09/07	1235	77	48
99.9997	9.9998	.9999	.0999	BW	09/08	1025	76	47
99.9998	9.9999	1.0000	.0999	BW	09/09	0915	78	47
99.9998	10.0000	1.0000	.1000	BW	09/16	1030	76	48
99.9999	10.0001	1.0000	.1000	BW	09/17	1145	77	46
99.9997	9.9999	.9999	.1000	BW	09/24	0835	75	47
99.9997	10.0000	1.0000	.0999	BW	09/25	1010	76	49
100.0000	10.0001	1.0000	.0999	BW	09/30	1115	75	47
99.9997	9.9998	.9999	.1000	BW	10/02	0955	77	49
99.9997	9.9998	1.0000	.0999	BW	10/03	0850	77	49
99.9997	9.9999	.9999	.1000	BW	10/04	1825	77	46
99.9997	9.9998	.9999	.0998	BW	10/05	1555	77	49
99.9999	10.0000	1.0000	.0999	BW	10/06	1105	77	46
99.9999	9.9999	1.0000	.1000	BW	10/07	2020	77	46
99.9999	10.0000	.9999	.1000	BW	10/08	1015	74	47
99.9999	9.9999	1.0001	.0998	BW	10/10	1830	75	47
99.9999	10.0000	.9999	.0998	BW	10/13	0945	78	49
99.9998	9.9999	1.0000	.1000	BW	10/14	1900	78	49
100.0000	9.9998	.9999	.0999	BW	10/15	2105	77	49
99.9999	9.9999	1.0000	.1000	BW	10/17	1600	78	48
99.9998	10.0001	.9999	.1000	BW	10/19	1210	78	48
99.9998	9.9999	1.0000	.0999	BW	10/20	1520	78	49

BLANK PROCESSING DATA SHEET # 5

UNIT: COUNTRY STORES-S210 RUN: 2 DATE: 10/14/03

DATE BLANKS DONE: 10/13/03

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 023283	FISHER OPTIMA LOT # 035941	DWNA, INC. SPARKLETES DISTILLED
FINAL WEIGHT	108.9015	106.3075	106.9665
TARE WEIGHT	108.8996	106.3060	106.9644
NET WEIGHT	.0019 ✓	.0015 ✓	.0021 ✓

TARE BEAKERS INTO DESC: TIME: 1635 DATE: 10/05/03

DATE: 10/07 BY: BZ DATE: 10/08 BY: BZ DATE: 10/09 BY: BZ

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8999	2038	108.8996	1021	✓	
B	106.3062	2039	106.3060	1022	✓	
C	106.9646	2040	106.9644	1023	✓	

FINAL BEAKERS INTO DESC: TIME: 0820 DATE: 10/09/03

DATE: 10/10 BY: BZ DATE: 10/13 BY: BZ DATE: 10/14 BY: BZ

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9013	0833	108.9015	0947	✓	
B	106.3070	0834	106.3075	0948	✓	
C	106.9664	0835	106.9665	0949	✓	

TARE QC

DATE	TIME	BY	WB	DB	%
10/07	2020	BZ	/	77	46
10/08	1015	BZ	/	74	47

FINAL QC

DATE	TIME	BY	WB	DB	%
10/10	0820	BZ	/	75	47
10/13	0945	BZ	/	78	49

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: COUNTRY STORES-S210 RUN: 2 DATE: 10/14/03

BLANK AUDIT: BY: C. Wadington DATE: 10-14-03

BLANK CALCULATIONS

Acetone: .0019 g ÷ 200 ml = .000010 g/ml ✓
 Dichloromethane: .0015 g ÷ 75 ml = .000020 g/ml ✓
 Distilled Water: .0021 g ÷ 200 ml = .000011 g/ml ✓

FRONT HALF CATCH

FILTERS: .2002 g - 1 (# of Filters) (.0000 g) Blank Value / Filter = .2002 g ✓
Total Catch

BEAKERS: .1482 g - 75 ml Acetone (.000010 g) Blank Value / ml Acetone = .1474 g ✓
Total Catch

TOTAL FRONT HALF CATCH: .3476 g ✓

BACK HALF CATCH

FILTERS: .0646 g - 1 (# of Filters) (.0000 g) Blank Value / Filter = .0646 g ✓
Total Catch

BEAKERS: Acetone: .2964 g - 150 ml Acetone (.000010 g) Blank Value / ml Acetone = .2949 g ✓
Total Catch

Extract: .0640 g - 75 ml Dichloromethane (.000020 g) Blank Value / Dichloromethane = .0625 g ✓
Total Catch

Water: .1718 g - 340 ml Water (.000011 g) Blank Value / Water = .1681 g ✓
Total Catch

TOTAL BACK HALF CATCH: .5901 g ✓

TOTAL CATCH: .9377 g ✓

% FRONT HALF: 37.1 % ✓
(00.0)

CALCULATIONS DATA SHEET # 7

UNIT: COUNTRY STORES - S210 RUN: 2 DATE: 10/14/03

$$1) Vm (std) = \frac{(94.503 \checkmark Vm) (17.64) (98 \checkmark / mcf) (30.20 \checkmark \text{ " Hg} + \frac{.145 \checkmark \text{ " H}_2\text{O}}{13.6})}{(550 \checkmark \text{ TmA})} = \frac{89.8278 \checkmark}{000.0000} \text{ dscf}$$

$$2) Vw (std) = (.04707) (144.2 \checkmark \text{ ml H}_2\text{O}) = \frac{6.7875 \checkmark}{00.0000} \text{ scf}$$

$$3) Asw = \frac{(6.7875 \checkmark \text{ scf})}{(6.7875 \checkmark \text{ scf} + 89.8278 \checkmark \text{ dscf})} = \frac{.0703 \checkmark}{.0000} \text{ Bws} \times 100 = \frac{7.0253 \checkmark}{00.0000} \% \text{ H}_2\text{O}$$

$$4) Cs = \frac{(.9377 \checkmark \text{ g.})}{(89.8278 \checkmark \text{ dscf})} (15.43) = \frac{.1611 \checkmark}{0.0000} \text{ gr / dscf}$$

$$5) \text{ Estimated g / hr} = \frac{(.9377 \checkmark \text{ g.})}{(89.8278 \checkmark \text{ dscf})} (7.437 \checkmark) \left(\frac{\text{dscfm}}{60} \right) = \frac{4.6580 \checkmark}{00.0000} \text{ g / hr}$$

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 ₂ O =	average delta H for test	(p. 2)	(.000 " H ₂ O)
TmA =	average meter temperature for test in degrees Absolute	(p. 2)	(000 TmA)
ml H ₂ O =	total water caught during test	(p. 3)	(000.0 ml H ₂ O)
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: COUNTRY STOVES-S210 RUN: 2 DATE: 10/14/03

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

Wet Bulb / Dry Bulb

Pre: WB: 64 DB: 81 = 38 % RH 1.4 % H₂O

Post: WB: 63 DB: 79 = 40 % RH 1.4 % H₂O

Average: 39.0 % RH 1.40 % H₂O

Empty Stove Weight (lbs): _____ w/ stack & oil seal: Wet: _____ Dry: 459.0

Kindling Weight (lbs): Paper: .2 Wood: 4.3

Preburn Fuel Weight: 16.0 + 12.5 + 13.3 Total: 41.8

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

Coal Bed Wt Range (lbs): 3.6 - 3.0 Scale: 462.6 - 462.0

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

Lower: .20 x fuel weight: Always round UP to nearest tenth

Actual Coal Bed Weight: 3.5

Maximum Coal Bed Removal (lbs): $(\frac{3.6}{\text{Upper}} + \frac{3.0}{\text{Lower}}) \div 2 \times .25 = \underline{8}$ round down to nearest tenth

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

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" x 4"	16.5	3	6.9	46.9
4" x 4"	16.5	2	7.8	53.1

Test Fuel Weight: 14.7 lbs

Estimated Dry Burn Rate:

$$\frac{14.7 - (14.7 \times .17596)}{2.2046} \times \frac{60}{310} = \underline{1.063} \text{ kg/hr}$$

$$\text{Estimated BTU's/hr: } 19,140 \times \frac{63}{100} \times \frac{1.063}{\text{DBR}} = \underline{12,823.5} \text{ BTU's/hr}$$

EPA Default Efficiencies:

Non-cat: 63

Cat: 72

Pellet: 78

WOOD STOVE OPERATING DATA PAGE #9

Unit: COUNTRY STOVES - S210 Run: 2 Date: 10/14/03

FIRE STARTED: 0830

WARM UP AND PREBURN:

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

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

CHARCOAL BED PREPARATION:

Raked and leveled prior to each warm-up / preburn charge. At 1 1/2 min. prior to loading last fuel, raked and leveled. In stove 25 sec.

TEST:

DOOR wide open during loading 0 min. 55 sec.

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

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

FAN:

ON / ~~OFF~~ during warm-up

ON / ~~OFF~~ first 30 minutes of test

Fan speed set at LOW

ON / OFF during preburn

ON / OFF balance of test run

WOOD DATA:

KINDLING: A mix of the grades listed below:

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

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

All Grades WCLB rules:

WARM UP INFORMATION:

All pre-burn / warm up fuel pieces were either 15 or 15 inches.

1st warm up / pre-burn fuel charge (16.0 lbs.) added at 0840

2nd warm up / pre-burn fuel charge (12.5 lbs.) added at 0940

3rd warm up / pre-burn fuel charge (13.3 lbs.) added at 1028

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 : COUNTRY STOVES - S210 Run : 2 Date : 10/14/03

Room Temperature : 72 °F Correction Factor : d

Uncorrected Values are corrected for room temperature : Yes No ✓

Time Test Fuel moisture reading taken : 1030 ✓

Calibration Checks : X ✓ Y ✓ 12.0 12.1 22.0 22.1

pc #	Dimen.	Use	TOP		BOTTOM		SIDE		Average Corrected
			Uncor.	Cor.	Uncor.	Cor.	Uncor.	Cor.	
1	2"x4"x8'	K	13.5	14.4	12.0	12.8	12.0	12.8	13.333 ✓
2									
3									
4	2"x4"x8'	P	21.5	23.1	22.0	23.7	22.0	23.7	23.500 ✓
5	2"x4"x8'	P	22.5	24.1	22.5	24.1	23.0	24.7	24.300 ✓
6	2"x4"x8'	P	18.0	19.2	18.5	19.8	18.5	19.8	19.600 ✓
7	2"x4"x8'	P	18.5	19.8	18.5	19.8	18.5	19.8	19.800 ✓
8	2"x4"x8'	P							87.200 ✓
9									
10									
11									
12	2"x4"x16.5"	T	18.5	19.8	18.5	19.8	18.0	19.2	19.600 ✓
13	2"x4"x16.5"	T	20.0	21.4	19.5	20.9	19.5	20.9	21.067 ✓
14	2"x4"x16.5"	T	21.5	23.1	22.0	23.7	21.5	23.1	23.300 ✓
15	4"x4"x16.5"	T	20.0	21.4	20.0	21.4	20.0	21.4	21.400 ✓
16	4"x4"x16.5"	T	20.0	21.4	20.0	21.4	20.0	21.4	21.400 ✓
17									106.767 ✓
18									
19									
20	Spacers	T	23.0	24.7	23.0	24.7	22.5	24.1	24.500 ✓

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	13.333 %	21.800 %	21.353 %
Wet Moisture % :	11.765 %	17.898 %	17.596 %

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

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

DATE: 10/14/03

RUN: 2

PAGE: 1 OF 2

PAGE: 2 OF 2

[illegible]

PREBURN D, A SHEET #13

UNIT: Country Studies - S210

22

DATE: 10/14/03

PAGE:

of

[illegible]

RUN 2

COUNTRY STOVES, INC. - S210

10/14/2003

TEMPERATURE DATA SHEET #14

		TEST TIME	310		
STACK AVG	232	TOP AVG	252	LT SIDE AVG	343
BACK AVG	241	RT SIDE AVG	336	BOTTOM AVG	265
FIREBOX AVG #####		SEC/CAT AVG	908	AMBIENT AVG	78

END	260.0	
START	340.5	
	-80.5	DELTA T

CIRCLE: LOSS GAIN

Time	Stack	Top	LT Side	Back	Rt Side	Bottom	Firebox	Sec/Cat Ambient	Tube Furn	Smpl Box	Smpl Out	C-Gas Box	C-Gas Out	SO2 Out
0	218	252	407	275	409	360	#####	774	78	1265	235	241	36	37
5	353	251	398	339	400	355	#####	1195	75	1274	233	241	36	38
10	267	269	384	345	387	352	#####	883	75	1279	231	240	37	35
15	246	272	368	341	371	347	#####	837	73	1284	233	242	37	36
20	241	271	354	332	356	340	#####	858	73	1287	235	245	36	37
25	255	273	345	322	345	332	#####	1173	73	1296	236	247	35	37
30	306	291	340	313	340	323	#####	1136	74	1303	238	249	35	38
35	314	315	339	248	338	314	#####	1196	76	1311	237	248	36	38
40	308	319	342	230	335	306	#####	1182	77	1320	237	248	36	39
45	298	320	343	219	334	298	#####	1145	77	1326	239	249	37	38
50	286	319	344	213	333	291	#####	999	78	1333	237	248	37	39
55	270	309	342	207	330	284	#####	1022	78	1339	238	248	38	38
60	265	297	341	203	327	278	#####	982	78	1343	235	247	38	38
65	264	289	341	199	323	271	#####	977	78	1346	234	246	39	37
70	276	286	342	196	321	267	#####	1031	78	1349	234	246	38	36
75	293	292	345	194	320	262	#####	1034	78	1350	233	246	36	36
80	304	305	350	193	320	257	#####	1097	79	1353	234	247	37	36
85	305	318	356	193	321	254	#####	1203	79	1356	234	249	36	36
90	296	324	360	194	329	251	#####	1190	79	1349	235	248	36	36
95	286	323	363	195	334	248	#####	1170	79	1342	235	248	37	36
100	286	319	364	196	337	246	#####	1153	79	1341	236	248	37	35
105	287	319	366	197	341	245	#####	1071	79	1341	237	247	37	35
110	274	316	370	198	344	243	#####	1032	79	1339	239	248	37	36
115	256	306	371	200	347	242	#####	932	79	1336	238	248	37	36
120	241	294	370	202	345	242	#####	888	79	1334	238	247	37	35
125	234	282	369	202	341	241	#####	885	79	1331	237	246	36	37
130	240	273	369	203	338	241	#####	931	79	1327	237	247	36	36
135	251	270	371	204	337	240	#####	1091	79	1325	238	246	36	37
140	257	277	371	208	341	239	#####	1087	79	1323	238	245	36	37
145	254	278	369	210	344	239	#####	1004	79	1324	238	245	37	38
150	243	274	364	215	348	239	#####	974	79	1325	238	244	37	38
155	233	268	357	218	350	239	#####	934	79	1326	238	245	37	38
160	223	261	350	220	352	239	#####	904	79	1327	237	245	37	37
165	216	253	343	221	349	240	#####	883	79	1328	237	245	36	37
170	210	246	338	223	345	240	#####	864	80	1329	236	246	36	38
175	206	239	333	225	342	241	#####	848	79	1329	236	245	36	38

Time	Stack	Top	LT Side	Back	Rt Side	Bottom	Firebox	Sec/Cat	Ambient	Tube Furn	Smpl Box	Smpl Out	C-Gas Box	C-Gas Out	SO2 Out
180	203	232	329	228	339	242	#####	838	79	1328	236	61	245	36	37
185	199	228	326	232	338	243	#####	838	79	1328	236	62	246	36	37
190	197	223	324	238	337	245	#####	811	79	1328	236	62	245	35	37
195	195	219	322	243	336	246	#####	802	79	1327	236	62	245	35	37
200	193	215	322	247	336	248	#####	799	79	1327	236	62	245	35	36
205	192	211	322	250	335	249	#####	794	79	1326	236	63	245	35	36
210	192	209	322	255	334	251	#####	792	79	1326	236	63	245	36	36
215	190	207	323	257	333	253	#####	791	78	1326	236	63	245	37	36
220	190	206	324	259	332	254	#####	789	79	1325	236	63	244	36	35
225	189	205	325	260	330	255	#####	786	78	1328	236	63	244	37	35
230	188	204	326	262	329	256	#####	784	78	1330	236	63	245	38	35
235	188	203	327	264	328	256	#####	781	78	1331	236	63	245	38	35
240	187	203	327	266	327	256	#####	781	78	1332	236	63	245	38	35
245	186	202	328	264	327	257	#####	783	78	1331	236	64	245	38	34
250	186	201	328	265	326	257	#####	779	78	1328	237	64	246	38	34
255	186	201	328	265	327	258	#####	771	79	1326	237	64	247	38	36
260	185	201	328	266	325	258	#####	761	79	1323	237	64	247	38	36
265	185	199	328	266	325	258	#####	754	78	1321	237	64	247	37	37
270	184	198	327	263	323	258	#####	734	79	1320	237	64	247	37	37
275	183	197	326	261	322	258	#####	730	78	1319	237	64	247	37	36
280	182	196	324	258	321	258	#####	727	78	1323	237	64	247	37	36
285	181	195	323	256	319	257	#####	724	78	1327	237	64	248	37	36
290	180	193	321	255	318	257	#####	721	78	1330	237	64	247	37	36
295	179	192	318	250	316	256	#####	708	78	1333	237	65	248	36	37
300	178	189	316	247	315	256	#####	700	76	1327	237	65	247	36	37
305	177	187	313	245	313	255	#####	693	75	1323	236	65	247	36	37
310	176	185	311	241	309	253	#####	687	73	1322	236	64	246	36	37

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 10/14/03 Analyte : CO₂ (15-1)
 Unit : COUNTY STOVES - S210 Run # : 2
 Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % CO₂ Cyl. Press. : 480 PSI
 Certified by : AIR LIQUIDE Date : 02-20-02
 Span Cyl. # : CC-3131 Conc. : 12.40 % CO₂ Cyl. Press. : 1025 PSI
 Certified by : AIR LIQUIDE Date : 03-13-03
 Analyzer : Make : HORIBA Model : PIR-2000 SN : 407069
 Range : 0 - 25.0 % CO₂ Analyzer Output : 0 - 1.0 v.
 Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % CO₂
 EPA Control Limits = ± 2.5% of 25.0 % CO₂ = ± 0.625 % CO₂
 Method 28 A = ± .2 % of 25.0 % CO₂ = ± .05 % CO₂

PRE RUN Audit : by : D. Wadsworth Time : 1110 Temp : 76 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-0.013	-0.013	-0.051 ✓
SPAN	49.6	.496	12.40	49.4	.494	12.322	-0.078	-0.312 ✓

POST RUN Audit : by : D. Wadsworth Time : 1735 Temp : 72 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-0.013	-0.013	-0.051 ✓
SPAN	49.6	.496	12.40	49.5	.495	12.347	-0.053	-0.212 ✓

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

ZERO / SPAN CHECK DATA SHEET #15-2

Date : 10/14/03 Analyte : O₂ (15-2)
 Unit : COUNTRY STOVES-S210 Run # : 2
 Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % O₂ Cyl. Press. : 480 PSI
 Certified by : AIR LIQUIDE Date : 02-20-02
 Span Cyl. # : CC-3131 Conc. : 12.40 % O₂ Cyl. Press. : 1025 PSI
 Certified by : AIR LIQUIDE Date : 03-13-03
 Analyzer : Make : TELEDYNE Model : 320 A SN : 37400
 Range : 0 - 25.0 % O₂ Analyzer Output : 0 - 1.0 v.
 Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % O₂
 EPA Control Limits = $\pm 2.5\%$ of 25.0 % O₂ = ± 0.625 % O₂
 Method 28 A = $\pm .2$ % of 25.0 % O₂ = $\pm .05$ % O₂

PRE RUN Audit : by : D. Wadlington Time : 1110 Temp : 76 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	0.000	+0.000	+0.001 ✓
SPAN	12.50	.500	12.50	12.45	.499	12.451	-0.049	-1.94 ✓

POST RUN Audit : by : D. Wadlington Time : 1735 Temp : 72 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	.025	+0.025	+1.01 ✓
SPAN	12.50	.500	12.50	12.45	.499	12.451	-0.049	-1.94 ✓

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

ZERO / SPAN CHECK DATA SHEET #15-3

Date: 10/14/03 Analyte: CO (15-3)
 Unit: COUNTRY STOVES - S210 Run #: 2
 Zero Cyl. #: 042TAC 2-A Conc.: 0.00 % CO Cyl. Press.: 480 PSI
 Certified by: AIR LIQUIDE Date: 02-20-02
 Span Cyl. #: CC-3131 Conc.: 12.40 % CO Cyl. Press.: 1025 PSI
 Certified by: AIR LIQUIDE Date: 03-13-03
 Analyzer: Make: HORIBA Model: PIR-2000 SN: 408005
 Range: 0 - 10.0 % CO Analyzer Output: 0 - 1.0 v.
 Flow: 1.5 SCFH Measured by: Rotameter

EPA Span Value = 10.0 % CO
 EPA Control Limits = $\pm 2.5\%$ of 10.0 % CO = ± 0.25 % CO
 Method 28 A = $\pm .2$ % of 10.0 % CO = $\pm .02$ % CO

PRE RUN Audit: by: D. Wadsworth Time: 1110 Temp: 76 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.001	+0.001	+0.012 ✓
SPAN	50.2	.502	5.02	50.1	.501	5.029	+0.009	+0.090 ✓

POST RUN Audit: by: D. Wadsworth Time: 1735 Temp: 72 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	.011	+0.011	+1.13 ✓
SPAN	50.2	.502	5.02	50.2	.502	5.039	+0.019	+1.90 ✓

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

ZERO / SPAN CHECK DATA SHEET #15-4

Date : 10/14/03 Analyte : SO₂ (15-4)
 Unit : COUNTRY STOVES S210 Run # : 2
 Zero Cyl. # : 042TAC 2-A Conc. : 0.00 ppm SO₂ Cyl. Press. : 480 PSI
 Certified by : AIR LIQUIDE Date : 02-20-02
 Span Cyl. # : CC62184 Conc. : 1290 ppm SO₂ Cyl. Press. : 850 PSI
 Certified by : AIR LIQUIDE Date : 01-29-01
 Analyzer : Make : HORIBA Model : PIR-2000 SN : 403019
 Range : 0 - 2500 ppm SO₂ Analyzer Output : 0 - 1.0 v.
 Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO₂
 EPA Control Limits = $\pm 2.5\%$ of 2500 ppm SO₂ = ± 62.5 ppm SO₂

PRE RUN Audit : by : D. Wadley Time : 1105 Temp : 77 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.3	.003	9.583	+9.583	+3.83 ✓
SPAN	51.6	.516	1290	51.4	.514	1280.837	-9.163	-3.67 ✓

POST RUN Audit : by : D. Wadley Time : 1735 Temp : 72 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	4.607	+4.607	+1.84 ✓
SPAN	51.6	.516	1290	51.5	.515	1283.325	-6.675	-2.67 ✓

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

QUALITY CHECKS DATA SHEET # 16

UNIT : COUNTRY STONES-S210 RUN : 2 DATE : 10/14/03

Thermocouple Check:

T/C # 1	<u>—</u>	°F	T/C # 13	<u>66.4</u>	°F
T/C # 2	<u>—</u>	°F	T/C # 14	<u>65.3</u>	°F
T/C # 3	<u>65.6</u>	°F	T/C # 15	<u>67.2</u>	°F
T/C # 4	<u>63.1</u>	°F	T/C # 16	<u>54.0</u>	°F
T/C # 5	<u>62.8</u>	°F	T/C # 17	<u>54.3</u>	°F
T/C # 6	<u>63.0</u>	°F	T/C # 18	<u>69.2</u>	°F
T/C # 7	<u>62.7</u>	°F	T/C # 19	<u>63.3</u>	°F
T/C # 8	<u>62.4</u>	°F	T/C # 20	<u>—</u>	°F
T/C # 9	<u>—</u>	°F	T/C # 21	<u>—</u>	°F
T/C # 10	<u>64.0</u>	°F	T/C # 22	<u>—</u>	°F
T/C # 11	<u>58.8</u>	°F	T/C # 23	<u>—</u>	°F
T/C # 12	<u>73.8</u>	°F	T/C # 24	<u>—</u>	°F

Thermocouple Readout:

Pretest zero and span check and calibration

post test zero and span

% difference

ZERO .3 °F Adj. to 0.0 °F

ZERO .9 °F Difference .045 %

SPAN 2000.0 °F Adj. to 2000.0 °F

SPAN 2001.3 °F Difference .065 %

Thermocouple Readout Pretest Linearity Check:

0	=	<u>0.0</u>	°F	200	=	<u>200.0</u>	°F	400	=	<u>399.9</u>	°F
600	=	<u>599.8</u>	°F	800	=	<u>799.6</u>	°F	1000	=	<u>999.7</u>	°F
1200	=	<u>1199.6</u>	°F	1400	=	<u>1399.5</u>	°F	1600	=	<u>1599.6</u>	°F
1800	=	<u>1799.8</u>	°F	2000	=	<u>2000.0</u>	°F				

Sample Train Leak Check

Pre ✓

Post ✓

C-gas Train Leak Check

Pre ✓

Post ✓

SO₂ Train Leak Check

Pre ✓

Post ✓

Static Gauge Zero Check

Pre ✓

Post X

Scale Check Pre :

474.6 - 464.6 ✓

Post :

472.4 - 462.4 ✓

Stack Cleaned Prior to Test Run : YES

NO

X

1.25 TO 1.90

COMPUTER INPUT DATA SHEET #1

Client: COUNTRY STOVES, INC.
 Address: 1502 14TH STREET NW
AUBURN, WA 98001
 Phone: 253-735-1100 Fax: 253-931-1271
 Run No.: 1 Date of Test: 10/13/03 Burn Rate: 1.438 ✓
 Model No.: S210 ☐ min ☐ min-1.25 ☒ fan-
 Stove Type: ☐ Cat ☒ Non Cat ☐ Pellet ☒ 1.25-1.9 ☐ max ☒ insert
 Dry Gas Meter Y Factor: .981 ✓ Post Leak Rate: .002 ✓ cfm Time: 215 ✓ min.
 (0.000) (Data Sheet #2) (0.000) (Data Sheet #2) (000) (Data Sheet #2)
 Dry Gas Meter Volume: 62.190 ✓ cf
 (00.000) (Data Sheet #2)
 Stack Flow: 8.653 ✓ dscfm Δ H: .138 ✓ in. H₂O
 (00.000) (Data Sheet #2) (0.000) (Data Sheet #2)
 Maximum Vac.: 3.0 ✓ Barometric Pressure: 30.25 ✓ in. Hg
 (0.0) (Data Sheet #2) (00.00) (Data Sheet #2)
 H₂O Captured: 107.6 ✓ g
 (00.0) (Data Sheet #3)
 Front Half Catch % Of Total: 42.0 ✓ % Total Particulate Catch: .3263 ✓
 (00.0) (Data Sheet #6) (0.0000) (Data Sheet #6)
 Flue Gas Moisture: 7.8402 ✓ %
 (00.000) (Data Sheet #7)
 Particulate Emission: .0846 ✓ gr/dscf
 (0.0000) (Data Sheet #7)
 Relative Humidity: 39.0 ✓ % RH Ambient Moisture: 1.40 ✓ % H₂O
 (00.0) (Data Sheet #8) (0.00) (Data Sheet #8)
 Preburn Fuel Wt.: 50.7 ✓ lbs. Coal Bed Wt.: 3.4 ✓ lbs. Test Fuel Wt.: 13.8 ✓ lbs.
 (00.0) (Data Sheet #8) (00.0) (Data sheet #8) (00.0) (Data sheet #8)
 Heat Output (EPA Default): 17,333.9 ✓ BTU/hr
 (00,000.0) (Data Sheet #8)
 Kindling Fuel % Moisture (wet): 14.310 ✓ % Pretest Fuel % Moisture (wet): 17.673 ✓
 (00.000) (Data Sheet #10) (00.000) (Data Sheet #10)
 Test Fuel % Moisture (dry): 21.520 ✓ % Test Fuel % Moisture (wet): 17.709 ✓
 (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: -.041 ✓ in. H₂O
 (+/- .000) (Data Sheet #12)
 Average Ambient Temperature: 74 ✓ °F Stove Temperature Change: -51.2 ✓ °F
 (00) (Data Sheet #14) (+/- 000.0) (Data Sheet #14)

TABLE 1 ----- RAW DATA

CLIENT : Country Stoves, Inc.

TEST No. : 1

MODEL: S210

DATE: 13-Oct-03

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	513.000	0.150	87	1.35	5.80	375
5	514.500	0.340	87	0.46	7.60	250
10	516.802	0.140	87	0.61	4.80	400
15	518.243	0.120	87	0.68	5.70	425
20	519.599	0.120	86	0.73	5.10	425
25	520.949	0.120	86	0.69	6.10	425
30	522.300	0.140	86	0.62	9.10	400
35	523.735	0.150	86	0.48	13.20	375
40	525.266	0.150	86	0.31	12.80	375
45	526.797	0.180	86	0.19	13.90	350
50	528.437	0.180	86	0.22	13.90	350
55	530.077	0.140	86	0.70	15.00	400
60	531.512	0.150	86	0.58	14.70	375
65	533.042	0.150	86	0.40	14.60	375
70	534.573	0.150	86	0.21	14.40	375
75	536.104	0.180	86	15.00	12.80	350
80	537.744	0.150	86	0.19	12.10	375
85	539.275	0.150	86	0.26	12.00	375
90	540.805	0.140	86	0.39	11.10	400
95	542.240	0.140	86	0.38	11.30	400
100	543.676	0.140	86	0.32	12.20	400
105	545.111	0.140	87	0.37	10.10	400
110	546.551	0.140	87	0.71	7.70	400
115	547.992	0.120	87	0.51	8.40	425
120	549.347	0.120	87	0.47	8.60	425
125	550.704	0.120	87	0.52	7.90	425
130	552.062	0.120	87	0.87	7.10	425
135	553.419	0.120	87	1.03	6.60	425
140	554.776	0.120	87	1.12	6.30	425
145	556.133	0.120	87	1.27	6.10	425
150	557.490	0.120	87	1.51	5.90	425
155	558.847	0.120	87	1.54	5.90	425
160	560.204	0.120	87	1.66	5.80	425
165	561.562	0.120	87	1.71	5.70	425
170	562.919	0.120	88	1.75	5.50	425
175	564.281	0.120	88	1.85	5.40	425
180	565.643	0.120	88	1.86	5.50	425
185	567.007	0.120	88	1.75	5.10	425
190	568.371	0.120	88	1.80	5.00	425
195	569.735	0.120	88	1.69	5.00	425
200	571.099	0.120	88	1.73	5.00	425
205	572.463	0.120	88	1.80	5.00	425
210	573.827	0.120	88	1.84	4.80	425
215	575.190	0.120	88	1.86	4.80	425

TABLE 2---RAW DATA

CLIENT : Country Stoves, Inc.

TEST No. 1

MODEL: S210

DATE: 13-Oct-03

METER CAL.		Wt. WOOD		
FACTOR (Y) -----	0.981	BURNED (LB) -----	13.8	Lbs

BAROMETRIC		WET, FUEL		
PRESS. (Pb) -----	30.25 in Hg	MOISTURE % -----	17.709	%

LEAK RATE		Wt. PART.		
POST (Lp) -----	0.002 cfm	COLLECTED -----	0.3263	g

WATER		METER		
VOL. (V1c) -----	107.6 Ml	VOLUME Vm -----	62.19	mcf

TEST		HC MOLE		
TIME (MIN) -----	215 min	FRACTION -----	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT :Country Stoves, Inc.

TEST No. 1

MODEL: S210

DATE: 13-Oct-03

AVG DELTA		AVG PRCNT		
H	----- 0.14 in H2O	CO	----- 1.27	%

AVG METER		AVG PRCNT		
TEMP. Tm	----- 87 deg F	CO2	----- 8.44	%

AVG PPM		AVG BAL		
SO2	----- 402 PPM	CO2/CO	----- 6.63	%

TABLE 4 ----- CALCULATIONS

CLIENT : Country Stoves, Inc.

TEST No. 1

MODEL: S210

DATE: 13-Oct-03

STD SAMPLE		STACK GAS	
VOL. Vm(std) -----	59.59 dscf	FLOW Qsd -----	469.467 dscf/Hr
			&
			7.82 dscf/min
VOL. WATER		PARTICULATE	
VAPOR Vw(std) ----	5.065 scf	CONCTRT. Cs -----	0.0055 g/dscf
PRCNT		PARTC. EMISS.	
MSTR Bws -----	7.83 %	RATE E -----	2.57 g/Hr
BURN		MOLES OF GAS	
RATE BR -----	1.44 Kg/Hr	PER Lb WOOD Nt --	0.38 Lb-mole/Lb
CO EMISSION		PART. EMISS.	
RATE -----	200.06 g/Hr	RATE -----	1.79 g/Kgdry
	&		fuel
	139.12 g/Kgdry		
	fuel		

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Country Stoves, Inc.

TEST No. : 1

MODEL: S210

DATE: 13-Oct-03

TIME INTERVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
=====	=====	=====	=====
5	538.8	98	100
10	551.5	100	
15	552.1	100	
20	552.5	100	
25	550.5	100	
30	551.0	100	
35	550.8	100	
40	550.9	100	
45	550.9	100	
50	550.9	100	
55	550.9	100	
60	550.8	100	
65	550.6	100	
70	550.9	100	
75	550.9	100	
80	550.9	100	
85	550.9	100	
90	550.6	100	
95	550.8	100	
100	551.2	100	
105	550.3	100	
110	551.7	100	
115	552.1	100	
120	551.6	100	
125	552.4	100	
130	552.8	100	
135	552.4	100	
140	552.4	100	
145	552.4	100	
150	552.4	100	
155	552.4	100	
160	552.4	100	
165	552.8	100	
170	551.9	100	
175	553.4	100	
180	553.4	100	
185	554.2	100	
190	554.2	100	
195	554.2	100	
200	554.2	100	
205	554.2	100	
210	554.2	100	
215	553.8	100	
220			

METER BOX DATA SHEET PAGE # 2

Page: 1 of 2

UNIT: Country Stores SZ10 RUN: 1 DATE: 10-13-03

Meter Box: 5H Y Factor: .981 ✓

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

15 " Hg @ 1002 cfm ✓ _____ " Hg @ _____ cfm

Inject SO₂ @ 100 cc/min. Nozzle: Probe @ 3/8" od Initial Volume: 1500

ROTO: PRESS: <u>17</u>			SAMPLING RATIO: <u>30</u> : 1				BP: <u>30.27</u>		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1445	513.000	—	9.202	.15	87	375	87	1.0
5	50	514.500	—	13.803	.34	87	250	87	3.0
10	55	516.802	516.802	8.627	.14	87	400	87	1.0
15	1500	518.243	518.243	8.119	.12	87	425	87	1.0
20	05	519.599	519.599	8.134	.12	86	425	86	1.0
25	10	520.949	520.949	8.134	.12	86	425	86	1.0
30	15	522.300	522.300	8.643	.14	86	400	86	1.0
35	20	523.735	523.735	9.219	.15	86	375	86	1.0
40	25	525.266	525.266	9.219	.15	86	375	86	1.0
45	30	526.797	526.797	9.877	.18	86	350	86	1.0
50	35	528.437	528.437	9.877	.18	86	350	86	1.0
55	40	530.077	530.077	8.643	.14	86	400	86	1.0
ROTO PRESS: <u>16</u>			TOTALS:		111.497	1.93	1036	BP: <u>30.27</u>	
60	1545	531.512	531.512	9.218	.15	86	375	86	1.0
65	50	533.042	533.042	9.218	.15	86	375	86	1.0
70	55	534.575	534.573	9.218	.15	86	375	86	1.0
75	1600	536.104	536.104	9.877	.18	86	350	86	1.0
80	05	537.744	537.744	9.218	.15	86	375	86	1.0
85	10	539.275	539.275	9.218	.15	86	375	86	1.0
90	15	540.805	540.805	8.642	.14	86	400	86	1.0
95	20	542.240	542.240	8.642	.14	86	400	86	1.0
100	25	543.676	543.676	8.642	.14	86	400	86	1.0
105	30	545.111	545.111	8.626	.14	87	400	87	1.0
110	35	546.551	546.551	8.626	.14	87	400	87	1.0
115	40	547.992	547.992	8.119	.12	87	425	87	1.0
			TOTALS:		107.264	1.75	1035	MAX VACC =	
TOTAL Cu Ft			TOTALS:		218.761	3.68	2071	AVG. BP:	

METER BOX DATA SHEET PAGE # 2

Page: 2 of 2

UNIT: Country Stores 5210 RUN: 1 DATE: 10-13-03

Meter Box: 5H Y Factor: .981 ✓

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

15 " Hg @ 1002 cfm ✓ _____ " Hg @ _____ cfm

Inject SO₂ @ 100 cc/min. Nozzle: Probe @ 3/8" od Initial Volume: 1,500

ROTO PRESS: <u>.16</u>			SAMPLING RATIO: <u>30</u> : 1			BP: <u>30.24</u>			
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1645	549.347	549.347	8.111	.12	87	425	87	1.0
125	50	550.704	550.704	8.111	.12	87	425	87	1.0
130	55	552.062	552.062	8.111	.12	87	425	87	1.0
135	1700	553.419	553.419	8.111	.12	87	425	87	1.0
140	05	554.776	554.776	8.111	.12	87	425	87	1.0
145	10	556.133	556.133	8.111	.12	87	425	87	1.0
150	15	557.490	557.490	8.111	.12	87	425	87	1.0
155	20	558.847	558.847	8.111	.12	87	425	87	1.0
160	25	560.204	560.204	8.111	.12	87	425	87	1.0
165	30	561.562	561.562	8.111	.12	87	425	87	1.0
170	35	562.919	562.919	8.096	.12	88	425	88	1.0
175	40	564.281	564.281	8.096	.12	88	425	88	1.0
ROTO PRESS: <u>.16</u>			TOTALS: 97.302			1.44	1046	BP: 30.20	
180	1745	565.643	565.643	8.086	.12	88	425	88	1.0
185	50	567.007	567.007	8.086	.12	88	425	88	1.0
190	55	568.371	568.371	8.086	.12	88	425	88	1.0
195	1800	569.735	569.735	8.086	.12	88	425	88	1.0
200	05	571.099	571.099	8.086	.12	88	425	88	1.0
205	10	572.463	572.463	8.086	.12	88	425	88	1.0
210	15	573.827	573.827	8.086	.12	88	425	88	1.0
215	20	575.190	575.190	8.086	.12	88	425	88	1.0
220	25		576.551			709			
225	30		(44) ✓	64.688	.96	3821			
230	35			16.990					
235	40			380.751	6.08	87			
			TOTALS:				MAX VACC =		3.0
TOTAL Cu Ft. 62.190			TOTALS:			8.053	.138	(547)	AVG. BP: 30.25

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT: Country stores ⁵²¹⁰ RUN: 1 DATE: 10-13-03

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

SCALE	WEIGHT
295.0 g	295.0
590.0 g	590.0
885.0 g	885.0

IMPINGER	#1	#2	#3	#4
FINAL WT	710.4	549.1	484.9	841.0
INITIAL WT	621.3	593.7	483.7	829.1
NET WT GRAMS	89.1	5.4	1.2	11.9

TOTAL CATCH: 107.6 GRAMS H₂O

FRONT HALF

FILTER #	175F	
FINAL WT g	.7925	✓
INITIAL WT g	.6955	✓
NET WT g	.10970	✓

BEAKER #	126
DESC.	ACETONE
FINAL WT g	105.8104 ✓
INITIAL WT g	105.7694 ✓
NET WT g	.0410 ✓
VOL. DESC. ml	100 ✓

BACK HALF

FILTER #	175B	
FINAL WT g	.4516	✓
INITIAL WT g	.4284	✓
NET WT g	.0232	✓

BEAKER #	127	128	129	130	
DESC.	ACETONE	METHCHLOR	H ₂ O	H ₂ O	
FINAL WT g	104.1727	105.6363	106.4554	106.5342	
INITIAL WT g	104.0771	105.6109	106.4320	106.5058	
NET WT g	.0956	.0254	.0234	.0284	.0518
VOL. DESC ml	150	75	150	185	(335)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : _____ Date : 05/12/2003 Time : 1215 By : DKW
 Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : ZB921
 Back Size : 8.2 cm Lot No. : ZB911

DATE: <u>05-15-03</u> BY: <u>DKW</u>		DATE: <u>05-16-03</u> BY: <u>DKW</u>		DATE: _____ BY: _____		
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
171F	.6931	1133	(.6931)	0942	HEARTHSTONE-TRIBUTE R-2	
172F	.6967	1134	(.6966)	0943	" " R-3	
173F	.6934	1135	(.6935)	0944	" " R-4	
174F	.6998	1136	(.6997)	0945	" " R-5	
175F	.6955	1137	(.6955)	0946	COUNTRY STOVES-S210 R#1	
176F	.6973	1137	(.6972)	0946	" " R-2	
177F	.6943	1138	(.6941)	0947	" " R-3	
178F	.6911	1139	(.6912)	0948	" " R-4	
179F	.6963	1140	(.6964)	0949		
180F	.6931	1141	(.6931)	0950		

171B	.4319	1151	(.4320)	0958	HEARTHSTONE-TRIBUTE R-2	
172B	.4326	1151	(.4325)	0959	" " R-3	
173B	.4259	1152	(.4260)	1000	" " R-4	
174B	.4310	1153	(.4307)	1001	" " R-5	
175B	.4282	1154	(.4284)	1001	COUNTRY STOVES-S210 R#1	
176B	.4238	1155	(.4239)	1002	" " R-2	
177B	.4311	1156	(.4309)	1003	" " R-3	
178B	.4351	1157	(.4350)	1004	" " R-4	
179B	.4299	1158	(.4300)	1005		
180B	.4311	1158	(.4309)	1005		

Checked by: C. W. Wadsworth Date: 5-16-03 Time: 1241

SCALE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	DB	% RH
05-15	1130	DKW	78	46
05-16	0930	DKW	73	45

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: ⁰⁹ Date: 09/18/2003 Time: 0900 By: DKW

BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
126	105.7690	0838	105.7694	1013		
127	104.0768	0839	104.0771	1014	COUNTRY STOKES-S210 R#1	
128	105.6108	0840	105.6109	1015		
129	106.4315	0841	106.4320	1016		
130	106.5054	0843	106.5058	1018		
131	106.8471	0844	106.8475	1019		
132	105.3860	0845	105.3862	1020	COUNTRY STOKES-S210 R#2	
133	106.5070	0846	106.5067	1021		
134	107.6923	0847	107.6926	1023		
135	104.5961	0848	104.5958	1024		
136	107.0835	0849	107.0840	1025		
137	104.1653	0850	104.1651	1027	COUNTRY STOKES-S210 R#3	
138	105.2454	0851	105.2450	1028		
139	104.4051	0852	104.4055	1029		
140	106.9637	0853	106.9640	1031		
141	102.2830	0854	102.2833	1032		
142	107.8136	0855	107.8140	1033	COUNTRY STOKES-S210 R#4	
143	105.5725	0856	105.5723	1035		
144	106.3813	0857	106.3817	1036		
145	101.5218	0858	101.5221	1037		
146	101.3692	0859	101.3694	1039		
147	106.9572	0860	106.9574	1040		
148	104.7573	0861	104.7577	1041		
149	107.5469	0862	107.5472	1042		
150	106.7053	0863	106.7055	1044		

SCALE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	DB	% RH	Checked by:
09/24	0835	DKW	75	47	Chp Wadsworth
09/25	1010	DKW	76	49	
					Date: 9-25-03
					Time: 1150

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : Country Stoves S210

RUN :

DATE :

10-13-03

Page : 1 of 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
126	10/14	1000	BW	105.8122	10/15	2108	BW	105.8108	10/17	1603	BW
127	10/14	0915	BW	104.1745	10/15	2109	BW	104.1731	10/17	1604	BW
128	10/14	0915	BW	105.6407	10/15	2110	BW	105.6384	10/17	1605	BW
129	10/14	0915	BW	106.4568	10/15	2111	BW	106.4558	10/17	1607	BW
130	10/14	0915	BW	106.5355	10/15	2112	BW	106.5345	10/17	1608	BW

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
175F	10-13	1830	CP	.7927	10/14	0903	BW	.7925	10/15	2113	BW
175B	10-13	1830	CP	.4534	10/14	0904	BW	.4521	10/15	2115	BW

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	10/14	0900	BW	78	49
2	10/15	2105	BW	77	49
3	10/17	1600	BW	78	48
4	10/19	1210	BW	78	48
5	10/20	1520	BW	78	47

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 02-24-2003 Through 06-18-2003	Scale: Sartorius	Model: A 120 S	SN: 37010004
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100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9998	10.000	1.0000	.0999	AKW	02-24	1055	74	44
99.9997	9.9998	1.0001	.0999	AKW	02-25	1700	77	45
100.0000	10.0001	1.0000	.0998	AKW	03-01	1010	71	44
99.9997	10.0001	.9998	.0999	AKW	03-02	1420	75	45
99.9998	10.0000	.9999	.1000	AKW	03-03	1205	76	45
99.9998	10.0000	1.0000	.1000	AKW	03-03	2005	77	47
100.0000	10.0001	1.0001	.0999	AKW	03-04	1035	75	47
99.9996	10.0001	1.0000	.0999	AKW	03-05	0945	71	47
99.9997	10.0001	1.0000	.1000	AKW	03-06	1340	74	46
99.9998	9.9999	1.0000	.0998	AKW	03-07	2050	76	45
99.9998	9.9999	1.0000	.0999	AKW	03-08	1150	77	45
99.9997	9.9998	1.0000	.1000	AKW	03-09	1350	76	45
99.9998	10.0000	.9999	.1000	AKW	03-10	1220	77	47
99.9997	9.9999	1.0000	.1000	AKW	03-18	1740	77	46
99.9997	9.9999	1.0000	.0999	AKW	03-20	2145	74	45
99.9998	10.0000	1.0000	.0998	AKW	03-22	1725	76	47
99.9997	10.0000	.9999	.1000	AKW	03-23	1405	77	47
99.9998	9.9998	.9999	.0999	AKW	03-24	1450	74	44
100.0000	9.9998	1.0000	.0998	AKW	03-25	1120	75	45
99.9998	10.0000	.9999	.0999	AKW	04-30	2300	75	47
99.9997	10.0001	.9999	.1000	AKW	05-02	1130	77	49
99.9998	9.9998	1.0000	.0999	AKW	05-06	2135	77	46
99.9997	9.9999	1.0001	.0999	AKW	05-09	0715	77	45
99.9998	10.0000	.9999	.0999	AKW	05-10	1435	78	47
99.9998	9.9999	1.0000	.0998	AKW	05-11	1210	77	46
99.9999	10.0001	.9999	.0999	AKW	05-12	0940	76	45
10.0001	10.0000	.9999	.1000	AKW	05-13	0910	77	46
99.9999	10.0001	1.0000	.0999	AKW	05-15	1120	78	46
99.9997	9.9999	1.0000	.0999	AKW	05-16	0930	73	45
100.0001	10.0000	.9999	.0999	AKW	05-17	1105	74	46
100.0000	9.9999	1.0000	.1000	AKW	05-18	1550	77	48
99.9997	10.0000	.9999	.0999	AKW	06-04	1025	76	46
99.9998	9.9999	1.0000	.0999	AKW	06-06	1035	78	49
99.9998	9.9999	1.0000	.0999	AKW	06-12	0950	73	43
99.9997	10.0002	1.0000	.0998	AKW	06-13	2115	78	46
99.9998	10.0000	1.0000	.0999	AKW	06-14	1110	78	46
99.9997	9.9999	1.0000	.1000	AKW	06-15	1110	78	47
99.9998	10.0001	1.0000	.1001	AKW	06-17	0905	78	48
99.9998	10.0000	.9999	.1000	AKW	06-18	1025	78	47

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 06-19-2003 Through 10-20-2003	Scale: Sartorius	Model: A 120 S	SN: 37010004
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100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0000	0.9999	.1001	BZ	06/19	0955	77	48
100.0000	10.0000	1.0000	.0999	BZ	06/19	1040	75	48
99.9998	9.9998	1.0000	.0999	BZ	07/23	0840	78	47
99.9997	9.9998	.9999	.0998	BZ	07/24	2200	78	48
99.9997	9.9999	.9999	.0997	BZ	07/25	0845	76	47
99.9999	10.0001	1.0000	.0999	BZ	07/26	1040	78	49
99.9997	9.9998	1.0000	.0998	BZ	07/27	1135	77	48
99.9999	10.0000	1.0000	.0999	BZ	07/29	2045	78	48
99.9997	9.9999	.9999	.0999	BZ	07/30	2100	77	48
99.9998	9.9998	.9999	.0999	BZ	08/01	1205	77	47
100.0000	10.0000	.9999	.0998	BZ	08/28	0915	74	49
99.9999	10.0000	1.0000	.0997	BZ	08/29	0715	78	46
99.9997	10.0001	.9998	.0997	BZ	09/02	0930	77	48
99.9997	10.0000	.9999	.0999	BZ	09/03	0815	77	48
99.9999	9.9999	1.0000	.1000	BZ	09/04	0855	78	49
99.9998	9.9999	1.0000	.0999	BZ	09/05	1110	78	48
99.9997	10.0000	.9998	.0998	BZ	09/06	1940	78	49
99.9997	9.9999	1.0000	.1000	BZ	09/07	1235	77	48
99.9997	9.9998	.9999	.0999	BZ	09/08	1025	76	47
99.9998	9.9999	1.0000	.0999	BZ	09/09	0915	78	47
99.9998	10.0000	1.0000	.1000	BZ	09/16	1030	76	48
99.9999	10.0001	1.0000	.1000	BZ	09/17	1145	77	46
99.9997	9.9999	.9999	.1000	BZ	09/24	0835	75	47
99.9997	10.0000	1.0000	.0999	BZ	09/25	1010	76	49
100.0000	10.0001	1.0000	.0999	BZ	09/30	1115	75	47
99.9997	9.9998	.9999	.1000	BZ	10/02	0955	77	49
99.9997	9.9998	1.0000	.0999	BZ	10/03	0850	77	49
99.9997	9.9999	.9999	.1000	BZ	10/04	1825	77	46
99.9997	9.9998	.9999	.0998	BZ	10/05	1555	77	49
99.9999	10.0000	1.0000	.0999	BZ	10/06	1105	77	46
99.9999	9.9999	1.0000	.1000	BZ	10/07	2020	77	46
99.9999	10.0000	.9999	.1000	BZ	10/08	1015	74	47
99.9999	9.9999	1.0001	.0998	BZ	10/10	1830	75	47
99.9999	10.0000	.9999	.0998	BZ	10/13	0945	78	49
99.9998	9.9999	1.0000	.1000	BZ	10/14	0900	78	49
100.0000	9.9998	.9999	.0999	BZ	10/15	2105	77	49
99.9999	9.9999	1.0000	.1000	BZ	10/17	1600	78	48
99.9998	10.0001	.9999	.1000	BZ	10/19	1210	78	48
99.9998	9.9999	1.0000	.0999	BZ	10/20	1520	78	49

BLANK PROCESSING DATA SHEET # 5

UNIT: COUNTRY STORES-S210 RUN: 1 DATE: 10/13/03

DATE BLANKS DONE: 10/13/03

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 023283	FISHER OPTIMA LOT # 035941	DWNA, INC. SPARKLETES DISTILLED
FINAL WEIGHT	108.9015	106.3075	106.9665
TARE WEIGHT	108.8996	106.3060	106.9644
NET WEIGHT	.0019 ✓	.0015 ✓	.0021 ✓

TARE BEAKERS INTO DESC: TIME: 1635 DATE: 10/05/03

DATE: 10/07 BY: BZ DATE: 10/08 BY: BZ DATE: 10/09 BY: BZ

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8999	2038	(108.8996)	1021	✓	
B	106.3062	2039	(106.3060)	1022	✓	
C	106.9646	2040	(106.9644)	1023	✓	

FINAL BEAKERS INTO DESC: TIME: 0800 DATE: 10/09/03

DATE: 10/10 BY: BZ DATE: 10/13 BY: BZ DATE: 10/14 BY: BZ

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9013	0833	(108.9015)	0947	✓	
B	106.3070	0834	(106.3075)	0948	✓	
C	106.9664	0835	(106.9665)	0949	✓	

TARE QC

DATE	TIME	BY	WB	DB	%
10/07	2020	BZ	✓	77	46
10/08	1015	BZ	✓	74	47

FINAL QC

DATE	TIME	BY	WB	DB	%
10/10	0830	BZ	✓	75	47
10/13	0945	BZ	✓	78	49

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: COUNTRY STORES-S210 RUN: 1 DATE: 10-13-03

BLANK AUDIT: BY: C. Wadington DATE: 10-14-03

BLANK CALCULATIONS

Acetone: .0019 g ÷ 200 ml = .000010 ✓g/ml
 Dichloromethane: .0015 g ÷ 75 ml = .000020 ✓g/ml
 Distilled Water: .0021 g ÷ 200 ml = .000011 ✓g/ml

FRONT HALF CATCH

FILTERS: .0970 g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0970 g
Total Catch

BEAKERS: .0410 g - 100 ml Acetone (.000010 g) (Blank Value / ml Acetone) = .0400 g
Total Catch

TOTAL FRONT HALF CATCH: .1370 g ✓

BACK HALF CATCH

FILTERS: .0232 g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0232 g
Total Catch

BEAKERS: Acetone: .0956 g - 150 ml Acetone (.000010 g) (Blank Value / ml Acetone) = .0941 g
Total Catch

Extract: .0254 g - 75 ml Dichloromethane (.000020 g) (Blank Value / Dichloromethane) = .0239 g
Total Catch

Water: .0518 g - 335 ml Water (.000011 g) (Blank Value / Water) = .0481 g
Total Catch

TOTAL BACK HALF CATCH: .1893 g ✓

TOTAL CATCH: .3263 g ✓

% FRONT HALF: 42.0 % ✓
 (00.0)

CALCULATIONS DATA SHEET # 7

UNIT: COUNTRY STUDIES - S210

RUN: 1

DATE: 10/13/03

$$1) Vm (std) = \frac{(62.190 Vm) (17.64) (981 mcf) (30.25" Hg + \frac{138" H_2O}{13.6})}{(547 TmA)} = \frac{59.5349}{000.0000} dscf$$

$$2) Vw (std) = (.04707) (\frac{107.6}{ml H_2O}) = \frac{5.0647}{00.0000} scf$$

$$3) Asw = \frac{(\frac{5.0647 scf}{scf + 59.5349 dscf})}{.0784} = \frac{.0784}{.0000} Bws \times 100 = \frac{7.8402}{00.0000} \% H_2O$$

$$4) Cs = \frac{(\frac{3263 g.}{59.5349 dscf})}{(15.43)} = \frac{.0846}{0.0000} gr / dscf$$

$$5) Estimated g / hr = \frac{(\frac{3263 g.}{59.5349 dscf})}{(8.653)} = \frac{2.8455}{00.0000} dscfm (60) = \frac{2.8455}{00.0000} g / hr$$

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 ₂ O =	average delta H for test	(p. 2)	(.000 " H ₂ O)
TmA =	average meter temperature for test in degrees Absolute	(p. 2)	(000 TmA)
ml H ₂ O =	total water caught during test	(p. 3)	(000.0 ml H ₂ O)
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: Country Stoves S210 RUN: 1 DATE: 10-13-03

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

Wet Bulb / Dry Bulb Pre: WB: 63 DB: 79 = 40 % RH 1.4 % H₂O

Post: WB: 64 DB: 81 = 38 % RH 1.4 % H₂O

Average: 39.0 % RH 1.40 % H₂O

Empty Stove Weight (lbs): _____ w/ stack & oil seal: Wet: _____ Dry: 458.8

Kindling Weight (lbs): Paper: .2 Wood: 5.9

Preburn Fuel Weight: 14.6 + 13.5 + 16.7 Total: 44.8

Kindling & Preburn Fuel Weight (wood only) (lbs): Total: 50.7

Coal Bed Wt Range (lbs): 3.4 - 2.8 Scale: 462.2 - 461.6

Upper: .25 x fuel weight: Always round DOWN to nearest tenth
Lower: .20 x fuel weight: Always round UP to nearest tenth Actual Coal Bed Weight: 3.4

Maximum Coal Bed Removal (lbs): $(\frac{3.4}{\text{Upper}} + \frac{2.8}{\text{Lower}}) \div 2 \cdot .25 = \underline{.7}$ round down to nearest tenth

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

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" x 4"	<u>16.5</u>	<u>3</u>	<u>6.9</u>	<u>50.0</u>
4" x 4"	<u>16.5</u>	<u>2</u>	<u>6.9</u>	<u>50.0</u>

Test Fuel Weight: 13.8 lbs

Estimated Dry Burn Rate: $\frac{13.8 - (13.8 \times .17709)}{2.2046} \times \frac{60}{215} = \underline{1.438}$ kg / hr

Estimated BTU's/hr: $19,140 \times \frac{63}{100} \times \frac{1.438}{\text{DBR}} = \underline{17,333.9}$ BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit: COUNTRY STOVES - S210 Run: 1 Date: 10-13-03

FIRE STARTED: 0950

WARM UP AND PREBURN:

PRIMARY AIR: Set wide open for all warm-up / preburn fuel charges. Then set to .25" at start of preburn.

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

CHARCOAL BED PREPARATION:

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

TEST:

DOOR wide open during loading 0 min. 50 sec.

PRIMARY AIR: Opened full for first 5 min., then set to run setting of .25"

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

FAN:

ON / OFF during warm-up

ON / OFF first 30 minutes of test

Fan speed set at Low

ON / OFF during preburn

ON / OFF balance of test run

WOOD DATA:

KINDLING: A mix of the grades listed below:

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

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

All Grades WCLB rules:

WARM UP INFORMATION:

All pre-burn / warm up fuel pieces were either 15 or 13 inches.

1st warm up / pre-burn fuel charge (14.6 lbs.) added at 1000

2nd warm up / pre-burn fuel charge (13.5 lbs.) added at 1115

3rd warm up / pre-burn fuel charge (16.7 lbs.) added at 1245

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 : Country Stores S-210 Run : 1 Date : 10-13-03

Room Temperature : 69 °F Correction Factor : 0

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

Time Test Fuel moisture reading taken : 1225

Calibration Checks : X ✓ Y ✓ 12.0 ✓ 12.2 ✓ 22.0 ✓ 22.0 ✓

pc #	Dimen.	Use	TOP		BOTTOM		SIDE		Average Corrected
			Uncor.	Cor.	Uncor.	Cor.	Uncor.	Cor.	
1	2"x4"x8'	K	16.5	17.6	15.0	16.0	15.5	16.5	16.700
2									
3									
4	2"x4"x8'	P	19.0	20.3	18.0	19.2	18.0	19.2	19.567
5	2"x4"x8'	P	19.5	20.9	20.5	22.0	20.0	21.4	21.433
6	2"x4"x8'	P	22.0	23.7	22.0	23.7	22.0	23.7	23.700
7	2"x4"x8'	P	19.0	20.3	20.0	21.4	20.0	21.4	21.033
8	2"x4"x8'	P	20.0	21.4	20.0	21.4	20.5	22.0	21.600
9									107.333
10									
11									
12	2x4x16.5	T	18.5	19.8	18.5	19.8	18.0	19.2	19.600
13	"	T	19.5	20.9	19.5	20.9	19.5	20.9	20.900
14	"	T	22.0	23.7	22.0	23.7	22.0	23.7	23.700
15	4x4x16.5	T	20.0	21.4	20.0	21.4	20.0	21.4	21.400
16	"	T	20.5	22.0	20.5	22.0	20.5	22.0	22.000
17									107.600
18									
19									
20	Spacers	T	18.5	19.8	19.0	20.3	19.0	20.3	20.133

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	16.700 %	21.467 %	21.520 %
Wet Moisture % :	14.310 %	17.673 %	17.709 %

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

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

GAS DATA SHEET #12

WEIGHT: 462.2

DATE: 10/13/03

UNIT: COUNTRY STOVES - S210

RUN: 1

PAGE: 1 OF 2

UNIT: COUNTRY STUDIES - 2210				RUN:		PAGE:					
TIME	SCALE	FUEL	DROP	V.	CO ₂	V.	O ₂	V.	CO	STATIC	SO ₂ PPM
0 1445	476.0	3.8	-	.234	5.8	.546	13.6	.134	1.35	-035	375
5 50	475.4	13.2	.6	.306	7.6	.509	12.7	.046	.46	-051	250
10 55	475.1	12.9	.3	.191	4.8	.618	15.4	.061	.61	-041	400
15 1500	474.7	12.5	.4	.229	5.7	.678	14.4	.068	.68	-041	425
20 05	474.3	12.1	.4	.206	5.1	.599	14.9	.073	.73	-041	425
25 10	473.9	11.7	.4	.245	6.1	.561	14.0	.069	.69	-041	425
30 15	473.4	11.2	.5	.365	9.1	.444	11.1	.062	.62	-044	400
35 20	472.7	10.5	.7	.531	13.2	.283	7.1	.048	.48	-040	375
40 25	471.9	9.7	.8	.515	12.8	.306	7.6	.031	.31	-051	375
45 30	471.3	9.1	.6	.556	13.9	.270	6.7	.019	.19	-052	350
50 35	470.6	8.4	.7	.556	13.9	.269	6.7	.022	.22	-053	350
55 40	469.9	7.7	.7	.603	15.0	.202	5.1	.070	.70	-054	400
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-544	*****
60 1545	469.2	7.0	.7	.591	14.7	.219	5.5	.058	.58	-054	375
65 50	468.6	6.4	.6	.584	14.6	.234	5.8	.040	.40	-051	375
70 55	468.0	5.8	.6	.579	14.4	.246	6.1	.021	.21	-052	375
75 1600	467.4	5.2	.6	.513	12.8	.315	7.9	.015	.15	-051	350
80 05	467.0	4.8	.4	.485	12.1	.341	8.5	.019	.19	-050	375
85 10	466.5	4.3	.5	.482	12.0	.341	8.5	.026	.26	-048	375
90 15	466.1	3.9	.4	.444	11.1	.374	9.3	.039	.39	-046	400
95 20	465.7	3.5	.4	.454	11.3	.364	9.1	.038	.38	-046	400
100 25	465.3	3.1	.4	.491	12.2	.330	8.2	.032	.32	-046	400
105 30	464.9	2.7	.4	.406	10.1	.413	10.3	.037	.37	-045	400
110 35	464.7	2.5	.2	.308	7.7	.497	12.4	.071	.71	-043	400
115 40	464.5	2.3	.2	.337	8.4	.476	11.9	.051	.51	-041	425
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-573	*****
120 1645	464.3	2.1	.2	.344	8.6	.471	11.8	.047	.47	-041	425
125 50	464.0	1.8	.3	.317	7.9	.496	12.4	.052	.52	-040	425
130 55	463.9	1.7	.1	.285	7.1	.514	12.8	.087	.87	-038	425
135 1700	463.8	1.6	.1	.266	6.6	.527	13.1	.102	1.03	-037	425
140 05	463.7	1.5	.1	.254	6.3	.535	13.4	.111	1.12	-036	425
145 10	463.5	1.3	.2	.246	6.1	.537	13.4	.126	1.27	-036	425
150 15	463.4	1.2	.1	.235	5.9	.539	13.4	.150	1.51	-036	425
155 20	463.3	1.1	.1	.235	5.9	.537	13.4	.153	1.54	-035	425
160 25	463.2	1.0	.1	.233	5.8	.535	13.3	.165	1.66	-034	425
165 30	463.1	.9	.1	.207	5.7	.539	13.4	.170	1.71	-034	425
170 35	463.0	.8	.1	.219	5.5	.545	13.6	.174	1.75	-034	425
175 40	462.9	.7	.1	.218	5.4	.542	13.5	.184	1.85	-033	425
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-434	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-1551	*****

GAS DATA SHEET #12

WEIGHT: 462.2

DATE: 10/13/03

UNIT: COUNTRY STOVES - S210

RUN: 1

PAGE: 2 OF 2

[illegible]

PREBURN DATA SHEET #13

PAGE: 1 of 1

DATE: 10-13-03 PAGE:

RUN:

5125

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SECCAT	AMBIENT	STATIC	COMMENTS
2:30	464.2	—	565	598	517	453	544	402	←	1361	79	-058	PREBURN START: # 2.0 UP
3:35	463.9	.3	397	557	517	386	547	405	↗	1244	80	-052	COAL BED SCALE RANGE:
4:40	463.7	.2	355	500	512	368	542	403	↘	1175	79	-048	462.2 - 461.6
5:45	463.5	.2	335	458	502	353	535	400	↖	1135	79	-046	PRIMARY AIR: 125"
6:50	463.3	.2	316	409	486	341	521	397	↗	1090	78	-045	SECONDARY AIR: N/A
7:55	463.1	.2	303	379	475	333	510	394	↘	1035	78	-042	FAN: Low
8:50	463.0	.1	294	357	465	325	499	389	↖	1018	78	-041	PUMPS ON AT: 1405
9:55	462.9	.1	281	333	455	324	484	386	↗	987	80	-040	CHECK WB/DB: N/A
10:10	462.7	.2	270	318	446	322	471	382	↘	961	82	-038	
11:15	462.7	0	263	303	437	318	460	379	↖	940	82	-037	
12:20	462.5	.2	257	287	426	312	447	374	↗	917	81	-036	
13:25	462.5	0	254	281	420	310	442	371	↘	904	82	-036	
14:30	462.4	.1	248	271	412	304	433	368	↖	871	80	-035	
15:35	462.3	.1	243	260	404	299	422	364	↗	848	77	-035	
16:40	462.3	0	238	252	396	296	411	358	↘	837	72	-035	
17:45	462.2	.1	239	246	389	288	403	356	↖	805	74	-035	

RUN 1

COUNTRY STOVES, INC. - S210

10/13/2003

TEMPERATURE DATA SHEET #14

		TEST TIME	215		
STACK AVG	281	TOP AVG	287	LT SIDE AVG	374
BACK AVG	258	RT SIDE AVG	380	BOTTOM AVG	287
FIREBOX AVG #####		SEC/CAT AVG	1002	AMBIENT AVG	74 ✓

END	285.0	
START	336.2	
	-51.2	DELTA T

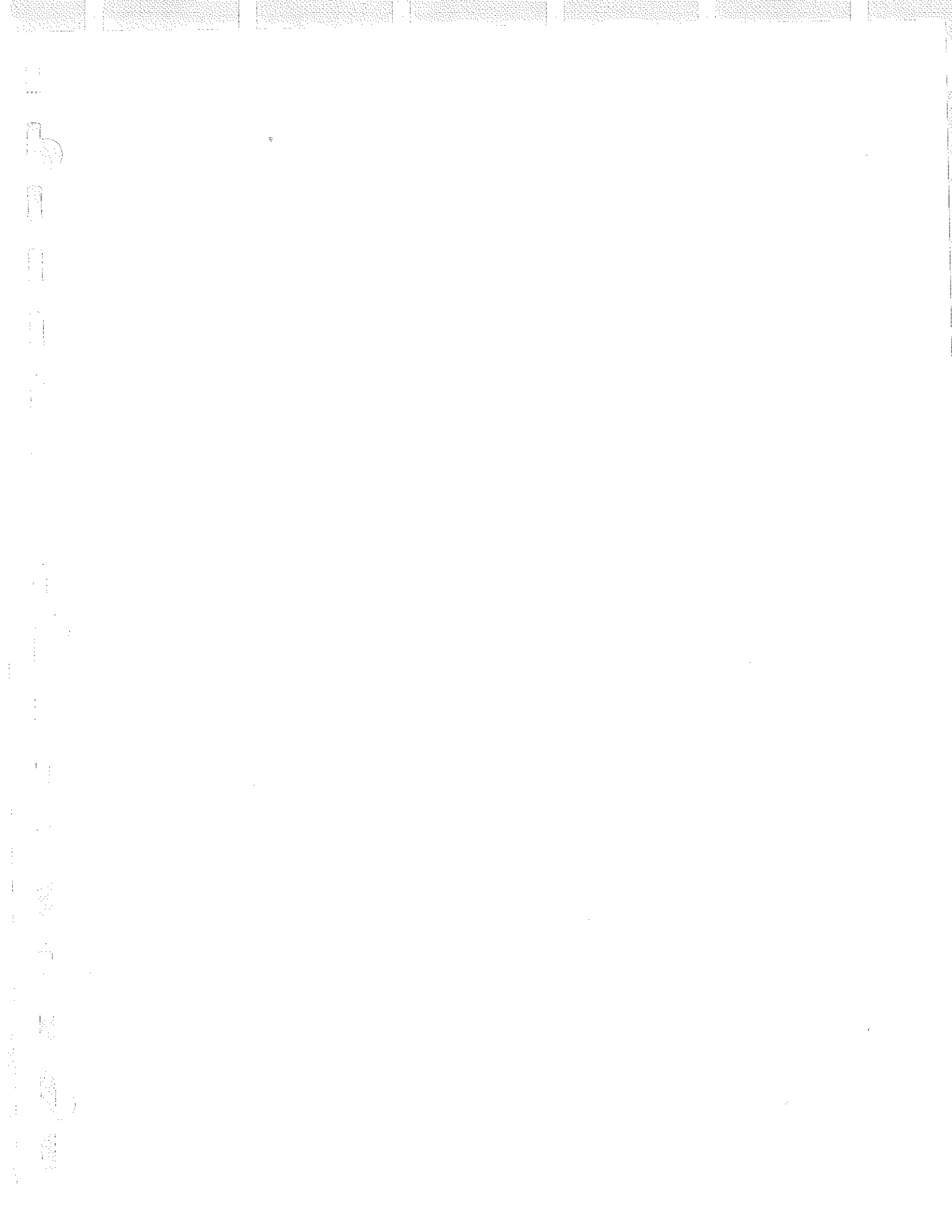
CIRCLE: LOSS GAIN

TEMPERATURE DATA SHEET #14A

COUNTRY STOVES, INC. - S210

Time	Stack	Top	LT Side	Back	Rt Side	Bottom	Firebox	Sec/Cat	Ambient	Tube Furn	Smpl Box	Smpl Out	C-Gas Box	C-Gas Out	SO2 Out
0	239	246	389	288	403	356	#####	805	74	1337	237	63	247	38	36
5	361	245	384	357	397	348	#####	1164	72	1340	236	43	248	38	37
10	270	258	372	365	384	351	#####	867	72	1333	236	42	248	39	36
15	258	260	357	357	367	346	#####	963	71	1328	235	43	248	39	35
20	255	262	343	345	352	339	#####	925	70	1324	236	43	247	36	35
25	259	266	331	334	343	329	#####	1030	71	1323	236	43	246	37	35
30	281	271	322	322	336	323	#####	1187	71	1324	237	44	246	37	37
35	337	285	320	250	335	315	#####	1260	71	1324	237	44	246	38	37
40	352	307	321	230	337	308	#####	1245	71	1326	238	43	247	36	38
45	363	327	323	218	342	300	#####	1210	71	1329	238	43	248	35	37
50	369	345	326	212	347	294	#####	1192	71	1331	238	43	249	35	36
55	379	362	331	209	353	287	#####	1203	71	1334	239	43	248	35	36
60	377	375	339	207	363	283	#####	1216	73	1337	239	44	248	35	35
65	369	381	348	207	372	278	#####	1226	73	1336	238	44	248	36	35
70	365	382	358	210	381	275	#####	1242	74	1333	238	44	248	37	35
75	355	381	367	211	390	273	#####	1216	74	1331	237	45	248	37	36
80	340	374	375	213	397	271	#####	1159	74	1331	237	45	247	37	36
85	331	365	382	217	403	271	#####	1215	74	1331	236	45	247	38	36
90	322	357	390	220	408	269	#####	1189	75	1331	235	45	247	37	36
95	317	348	398	223	411	269	#####	1224	75	1330	235	45	246	38	36
100	317	340	404	229	415	269	#####	1220	75	1329	235	45	245	38	36
105	308	335	410	233	418	270	#####	1162	75	1328	234	46	245	38	36
110	289	328	412	237	419	270	#####	1055	74	1329	234	46	243	39	36
115	282	319	411	242	417	270	#####	1069	74	1330	233	46	243	39	36
120	278	310	410	246	416	270	#####	1074	74	1330	234	46	243	39	36
125	271	305	411	253	415	271	#####	1032	76	1331	235	47	243	39	36
130	263	296	411	259	415	272	#####	968	76	1332	235	47	242	38	37
135	256	287	410	261	412	271	#####	942	76	1333	236	48	241	38	38
140	250	277	410	262	407	273	#####	913	76	1334	236	48	240	38	38
145	245	268	406	262	402	272	#####	893	75	1333	236	48	240	38	37
150	241	259	404	261	397	273	#####	871	75	1333	236	48	240	38	39
155	236	255	400	264	392	274	#####	860	76	1329	235	47	241	37	39
160	233	248	397	263	388	274	#####	847	76	1326	236	47	242	37	39
165	229	243	392	263	383	274	#####	833	76	1325	236	47	243	37	38
170	227	236	387	261	380	273	#####	819	75	1324	236	48	243	37	38
175	224	231	384	264	375	273	#####	806	76	1324	236	48	243	37	38

Time	Stack	Top	LT Side	Back	Rt Side	Bottom	Firebox	Sec/Cat	Ambient	Tube	Furn	Smpl Box	Smpl Out	C-Gas Box	C-Gas Out	SO2 Out
180	221	227	380	264	371	273	#####	798	76	1329		236	49	243	37	37
185	218	223	375	264	367	273	#####	780	76	1333		236	49	243	37	38
190	215	219	371	264	363	273	#####	764	76	1336		236	49	242	36	38
195	213	215	367	263	358	272	#####	753	76	1338		236	49	242	37	37
200	211	212	363	264	354	272	#####	744	75	1340		236	50	242	36	37
205	209	209	359	261	350	271	#####	733	75	1338		236	49	241	36	37
210	207	205	356	261	345	271	#####	719	75	1334		236	49	241	36	37
215	205	202	352	260	342	269	#####	712	74	1331		235	49	241	36	34



ZERO / SPAN CHECK DATA SHEET #15-1

Date: 10/13/03 Analyte: CO₂ (15-1)
 Unit: COUNTY STOVES - 8210 Run #: 1
 Zero Cyl. #: 042TAC 2-A Conc.: 0.00 % CO₂ Cyl. Press.: 480 PSI
 Certified by: AIR LIQUIDE Date: 02-20-02
 Span Cyl. #: CC-3131 Conc.: 12.40 % CO₂ Cyl. Press.: 1025 PSI
 Certified by: AIR LIQUIDE Date: 03-13-03
 Analyzer: Make: HORIBA Model: PIR-2000 SN: 407069
 Range: 0 - 25.0 % CO₂ Analyzer Output: 0 - 1.0 v.
 Flow: 1.5 SCFH Measured by: Rotameter

EPA Span Value = 25.0 % CO₂
 EPA Control Limits = $\pm 2.5\%$ of 25.0 % CO₂ = $\pm 0.625\%$ CO₂
 Method 28 A = $\pm .2\%$ of 25.0 % CO₂ = $\pm .05\%$ CO₂

PRE RUN Audit by: D. Wadsworth Time: 1255 Temp: 75 °F

AUDIT RESULTS

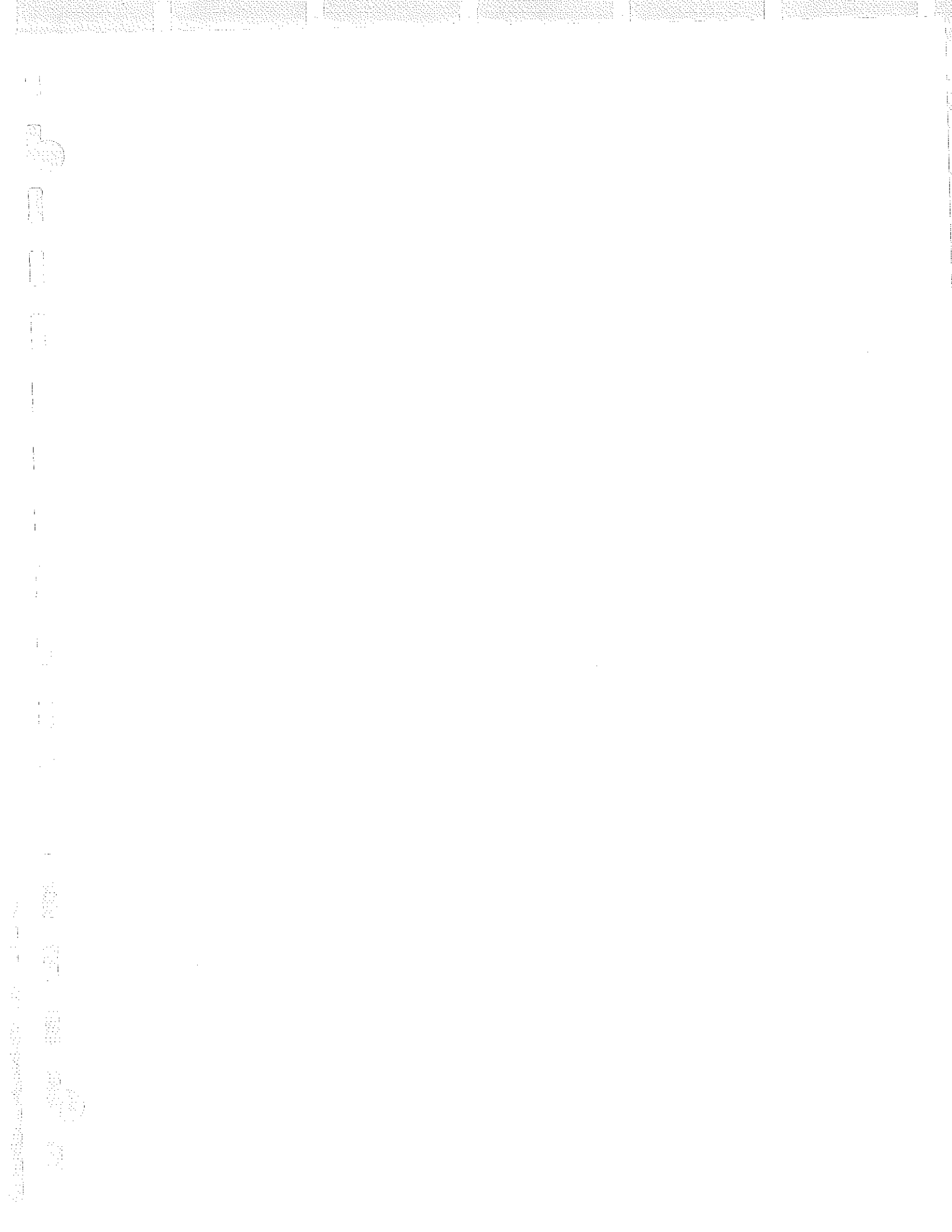
Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-0.013	-0.013	-0.051
SPAN	49.6	.496	12.40	49.6	.496	12.372	-0.028	-0.112

POST RUN Audit by: D. Wadsworth Time: 1840 Temp: 75 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-0.013	-0.013	-0.051
SPAN	49.6	.496	12.40	49.7	.497	12.397	-0.003	-0.012

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



ZERO / SPAN CHECK DATA SHEET #15-2

Date : 10/13/03 Analyte : O₂ (15-2)
 Unit : COUNTRY STOVES-S210 Run # : 1
 Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % O₂ Cyl. Press. : 480 PSI
 Certified by : AIR LIQUIDE Date : 02-20-02
 Span Cyl. # : CC-3131 Conc. : 12.40 % O₂ Cyl. Press. : 1025 PSI
 Certified by : AIR LIQUIDE Date : 03-13-03
 Analyzer : Make : TELEDYNE Model : 320 A SN : 37400
 Range : 0 - 25.0 % O₂ Analyzer Output : 0 - 1.0 v.
 Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % O₂
 EPA Control Limits = $\pm 2.5\%$ of 25.0 % O₂ = $\pm 0.625 % O_2$
 Method 28 A = $\pm .2 %$ of 25.0 % O₂ = $\pm .05 % O_2$

PRE RUN Audit : by : D. Wadlington Time : 1255 Temp : 75 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	00.0	.000	+0.001 ✓
SPAN	12.50	.500	12.50	12.50	.500	12.476	-.024	-0.094 ✓

POST RUN Audit : by : D. Wadlington Time : 1840 Temp : 75 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.000	.000	+0.001 ✓
SPAN	12.50	.500	12.50	12.45	.499	12.451	-.049	-1.94 ✓

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

ZERO / SPAN CHECK DATA SHEET #15-3

Date: 10/13/03 Analyte: CO (15-3)
 Unit: COUNTRY STOVES - S210 Run #: 1
 Zero Cyl. #: 042TAC 2-A Conc.: 0.00 % CO Cyl. Press.: 480 PSI
 Certified by: AIR LIQUIDE Date: 02-20-02
 Span Cyl. #: CC-3131 Conc.: 12.40 % CO Cyl. Press.: 1025 PSI
 Certified by: AIR LIQUIDE Date: 03-13-03
 Analyzer: Make: HORIBA Model: PIR-2000 SN: 408005
 Range: 0 - 10.0 % CO Analyzer Output: 0 - 1.0 v.
 Flow: 1.5 SCFH Measured by: Rotameter

EPA Span Value = 10.0 % CO
 EPA Control Limits = $\pm 2.5\%$ of 10.0 % CO = ± 0.25 % CO
 Method 28 A = $\pm .2$ % of 10.0 % CO = $\pm .02$ % CO

PRE RUN Audit: by: D. Wadlington Time: 1255 Temp: 75 °F

AUDIT RESULTS								
Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.001	+.001	+.012
SPAN	50.2	.502	5.02	50.2	.502	5.039	+.019	+.190

POST RUN Audit: by: D. Wadlington Time: 1840 Temp: 75 °F

AUDIT RESULTS								
Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	.011	+.011	+.113
SPAN	50.2	.502	5.02	50.1	.501	5.029	+.009	+.090

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

ZERO / SPAN CHECK DATA SHEET #15-4

Date : 10/13/03 Analyte : SO₂ (15-4)
 Unit : COUNTRY STOVES S210 Run # : 1
 Zero Cyl. # : 042TAC 2-A Conc. : 0.00 ppm SO₂ Cyl. Press. : 480 PSI
 Certified by : AIR LIQUIDE Date : 02-20-02
 Span Cyl. # : CC62184 Conc. : 1290 ppm SO₂ Cyl. Press. : 850 PSI
 Certified by : AIR LIQUIDE Date : 01-29-01
 Analyzer : Make : HORIBA Model : PIR-2000 SN : 403019
 Range : 0 - 2500 ppm SO₂ Analyzer Output : 0 - 1.0 v.
 Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO₂
 EPA Control Limits = $\pm 2.5\%$ of 2500 ppm SO₂ = ± 62.5 ppm SO₂

PRE RUN Audit : by : A. Wadington Time : 1255 Temp : 75 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	2.119	+2.119	+0.085 ✓
SPAN	51.6	.516	1290	51.6	.516	1285.813	-4.187	-1.167 ✓

POST RUN Audit : by : A. Wadington Time : 1840 Temp : 75 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	4.607	+4.607	+1.184 ✓
SPAN	51.6	.516	1290	51.8	.518	1290.788	+1.788	+0.032 ✓

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

QUALITY CHECKS DATA SHEET # 16

UNIT: Country SZ10 RUN: 1 DATE: 10-13-03

Thermocouple Check:

T/C # 1	<u> </u>	°F	T/C # 13	<u>58.1</u>	°F
T/C # 2	<u> </u>	°F	T/C # 14	<u>57.8</u>	°F
T/C # 3	<u>56.2</u>	°F	T/C # 15	<u>58.4</u>	°F
T/C # 4	<u>56.2</u>	°F	T/C # 16	<u>56.2</u>	°F
T/C # 5	<u>55.6</u>	°F	T/C # 17	<u>56.2</u>	°F
T/C # 6	<u>55.7</u>	°F	T/C # 18	<u>58.6</u>	°F
T/C # 7	<u>55.6</u>	°F	T/C # 19	<u>57.0</u>	°F
T/C # 8	<u>55.5</u>	°F	T/C # 20	<u> </u>	°F
T/C # 9	<u> </u>	°F	T/C # 21	<u> </u>	°F
T/C # 10	<u>55.6</u>	°F	T/C # 22	<u> </u>	°F
T/C # 11	<u>54.4</u>	°F	T/C # 23	<u> </u>	°F
T/C # 12	<u>60.8</u>	°F	T/C # 24	<u> </u>	°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 2.3 °F

Difference +1.15 %

SPAN 1997.2 °F Adj. to 2000.0 °F

SPAN 1999.8 °F

Difference -0.10 %

Thermocouple Readout Pretest Linearity Check:

0	=	<u>0.0</u>	°F	200	=	<u>200.2</u>	°F	400	=	<u>400.0</u>	°F
600	=	<u>599.8</u>	°F	800	=	<u>799.7</u>	°F	1000	=	<u>999.7</u>	°F
1200	=	<u>1199.6</u>	°F	1400	=	<u>1399.4</u>	°F	1600	=	<u>1599.5</u>	°F
1800	=	<u>1799.8</u>	°F	2000	=	<u>2000.0</u>	°F				

Sample Train Leak Check

Pre ✓

Post ✓

C-gas Train Leak Check

Pre ✓

Post ✓

SO₂ Train Leak Check

Pre ✓

Post ✓

Static Gauge Zero Check

Pre X

Post ✓

Scale Check Pre:

474.9 - 464.9 ✓

Post:

471.7 - 461.7 ✓

Stack Cleaned Prior to Test Run: YES

NO

COMPUTER INPUT DATA SHEET #1

Client: COUNTRY STOVES, INC.

Address: 1502 14TH STREET NW
AUBURN, WA 98001

Phone: 253-735-1100 Fax: 253-931-1271

Run No.: 3 Date of Test: 10/15/03 Burn Rate: 2.298 ✓

Model No.: S210 ☐ min ☐ min-1.25 ☒ fan

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

Dry Gas Meter Y Factor: .981 ✓ Post Leak Rate: .006 cfm Time: 155 min.
(0.000) (Data Sheet #2) (0.000) (Data Sheet #2) (000) (Data Sheet #2)

Dry Gas Meter Volume: 45.917 ✓ cf
(00.000) (Data Sheet #2)

Stack Flow: 13.649 ✓ dscfm ΔH : .133 ✓ in. H₂O
(00.000) (Data Sheet #2) (0.000) (Data Sheet #2)

Maximum Vac.: 3.0 ✓ Barometric Pressure: 29.71 ✓ in. Hg
(0.0) (Data Sheet #2) (00.00) (Data Sheet #2)

H₂O Captured: 68.2 ✓ g
(00.0) (Data Sheet #3)

Front Half Catch % Of Total: 59.3 % Total Particulate Catch: .1534 ✓ g
(00.0) (Data Sheet #6) (0.0000) (Data Sheet #6)

Flue Gas Moisture: 7.0623 %
(00.000) (Data Sheet #7)

Particulate Emission: .0560 ✓ gr/dscf
(0.0000) (Data Sheet #7)

Relative Humidity: 41.0 ✓ % RH Ambient Moisture: 1.50 ✓ % H₂O
(00.0) (Data Sheet #8) (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 57.3 ✓ lbs. Coal Bed Wt.: 3.9 ✓ lbs. Test Fuel Wt.: 116.0 ✓ lbs.
(00.0) (Data Sheet #8) (00.0) (Data sheet #8) (00.0) (Data sheet #8)

Heat Output (EPA Default): 27,703.8 ✓ BTU/hr
(00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 13.270 ✓ % Pretest Fuel % Moisture (wet): 16.915 ✓ %
(00.000) (Data Sheet #10) (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 22.280 ✓ % Test Fuel % Moisture (wet): 18.220 ✓ %
(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: -.058 ✓ in. H₂O
(+/- .000) (Data Sheet #12)

Average Ambient Temperature: 74 ✓ °F Stove Temperature Change: -99.5 ✓ °F
(00) (Data Sheet #14) (+/- 000.0) (Data Sheet #14)

Max DBR

TABLE 1 ----- RAW DATA

CLIENT : Country Stoves, Inc.

TEST No. : 3

MODEL: S210

DATE: 15-Oct-03

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	672.000	0.150	98	0.58	6.80	225
5	673.500	0.250	98	0.14	13.40	175
10	675.554	0.160	97	0.06	12.30	225
15	677.147	0.160	97	0.04	13.70	225
20	678.739	0.130	97	0.09	15.50	250
25	680.173	0.130	97	0.29	16.00	250
30	681.606	0.120	99	0.07	13.50	250
35	683.050	0.150	99	0.09	10.00	225
40	684.654	0.120	99	0.06	13.40	250
45	686.098	0.120	99	0.06	13.80	250
50	687.542	0.120	99	0.08	9.90	250
55	688.986	0.120	99	0.12	8.30	250
60	690.430	0.120	99	0.42	7.00	250
65	691.874	0.100	99	0.60	6.20	275
70	693.187	0.100	99	0.55	6.40	275
75	694.500	0.100	99	0.46	7.00	275
80	695.812	0.120	99	0.34	6.70	250
85	697.256	0.120	99	0.37	6.30	250
90	698.700	0.120	99	0.48	5.70	250
95	700.144	0.120	99	0.46	5.60	250
100	701.588	0.150	99	0.45	5.50	225
105	703.192	0.150	99	0.56	5.30	225
110	704.796	0.120	99	0.55	4.90	250
115	706.240	0.120	99	0.60	4.70	250
120	707.684	0.130	99	0.56	5.20	250
125	709.123	0.130	99	0.51	5.40	250
130	710.562	0.130	99	0.62	5.20	250
135	712.001	0.160	99	0.68	5.00	225
140	713.600	0.130	99	0.77	4.50	250
145	715.039	0.130	99	0.93	4.50	250
150	716.478	0.130	99	0.97	4.40	250
155	717.917	0.130	99	0.94	4.40	250
160						

TABLE 2---RAW DATA

CLIENT : Country Stoves, Inc.

TEST No.

3

MODEL: S210

DATE: 15-Oct-03

METER CAL.		Wt. WOOD		
FACTOR (Y)	----- 0.981	BURNED (LB)	----- 16.0	Lbs

BAROMETRIC		WET, FUEL		
PRESS. (Pb)	----- 29.71 in Hg	MOISTURE %	----- 18.22	%

LEAK RATE		Wt. PART.		
POST (Lp)	----- 0.006 cfm	COLLECTED	----- 0.1534	g

WATER		METER		
VOL. (V1c)	----- 68.2 Ml	VOLUME Vm	----- 45.917	mcf

TEST		HC MOLE		
TIME (MIN)	----- 155 min	FRACTION	----- 0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT :Country Stoves, Inc.

TEST No. 3

MODEL: S210

DATE: 15-Oct-03

AVG DELTA H	----- 0.13 in H2O	AVG PRCNT CO	----- 0.42	%
AVG METER TEMP. Tm	----- 99 deg F	AVG PRCNT CO2	----- 8.02	%
AVG PPM SO2	----- 245 PPM	AVG BAL CO2/CO	----- 19.00	%

TABLE 4 ----- CALCULATIONS

CLIENT : Country Stoves, Inc.

TEST No. 3

MODEL: S210

DATE: 15-Oct-03

STD SAMPLE		STACK GAS		
VOL. Vm(std) -----	42.29 dscf	FLOW Qsd -----	848.335	dscf/Hr
			14.14	& dscf/min
VOL. WATER		PARTICULATE		
VAPOR Vw(std) ----	3.210 scf	CONCTRT. Cs -----	0.0036	g/dscf
PRCNT		PARTC. EMISS.		
MSTR Bws -----	7.05 %	RATE E -----	3.08	g/Hr
BURN		MOLES OF GAS		
RATE BR -----	2.30 Kg/Hr	PER Lb WOOD Nt --	0.44	Lb-mole/Lb
CO EMISSION		PART. EMISS.		
RATE -----	119.85 g/Hr	RATE -----	1.34	g/Kgdry
	&			fuel
	52.15 g/Kgdry			
	fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Country Stoves, Inc.

TEST No. : 3

MODEL: S210

DATE: 15-Oct-03

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
=====	=====	=====	=====
5	311.3	94	100
10	331.9	100	
15	331.2	100	
20	330.9	100	
25	331.2	100	
30	330.4	100	
35	332.3	100	
40	332.2	100	
45	332.3	100	
50	332.3	100	
55	332.3	100	
60	332.3	100	
65	332.3	100	
70	332.4	100	
75	332.4	100	
80	332.1	100	
85	332.3	100	
90	332.3	100	
95	332.3	100	
100	332.3	100	
105	332.2	100	
110	332.2	100	
115	332.3	100	
120	332.3	100	
125	331.2	100	
130	331.2	100	
135	331.2	100	
140	331.2	100	
145	331.2	100	
150	331.2	100	
155	331.2	100	
160			
165			

METER BOX DATA SHEET PAGE # 2

Page: 1 of 2

UNIT: COUNTRY STORES - S210 RUN: 3

DATE: 10/15/03

Meter Box: 5H Y Factor: .981 ✓

Leak checks: 15 " Hg @ .001 cfm _____ " Hg @ _____ cfm

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

Inject SO₂ @ 100 cc/min.

Nozzle: Probe @ 3/8" od

Initial Volume: 1.500

ROTO: PRESS: <u>.16</u>			SAMPLING RATIO: <u>47</u>			: 1		BP: <u>29.68</u>		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC	
0	1450	672.000	_____	14.741	.15	98	225	98	2.0	
5	55	673.500	_____	18.952	.25	98	175	98	3.0	
10	1500	675.554	675.554	14.767	.16	97	225	97	2.0	
15	05	677.147	677.147	14.767	.16	97	225	97	2.0	
20	10	678.739	678.739	13.291	.13	97	250	97	2.0	
25	15	680.173	680.173	13.291	.13	97	250	97	2.0	
30	20	681.606	681.606	13.243	.12	99	250	99	2.0	
35	25	683.050	683.050	14.714	.15	99	225	99	2.0	
40	30	684.654	684.654	13.243	.12	99	250	99	2.0	
45	35	686.098	686.098	13.243	.12	99	250	99	2.0	
50	40	687.542	687.542	13.243	.12	99	250	99	2.0	
55	45	688.986	688.986	13.243	.12	99	250	99	2.0	
ROTO PRESS: <u>.16</u>			TOTALS:	170.738	1.73	1178	BP: <u>29.68</u>			
60	1550	690.430	690.430	13.243	.12	99	250	99	2.0	
65	55	691.874	691.874	12.039	.10	99	275	99	2.0	
70	1600	693.187	693.187	12.039	.10	99	275	99	2.0	
75	05	694.500	694.500	12.039	.10	99	275	99	2.0	
80	10	695.812	695.812	13.243	.12	99	250	99	2.0	
85	15	697.256	697.256	13.243	.12	99	250	99	2.0	
90	20	698.700	698.700	13.243	.12	99	250	99	2.0	
95	25	700.144	700.144	13.243	.12	99	250	99	2.0	
100	30	701.588	701.588	14.714	.15	99	225	99	2.0	
105	35	703.192	703.192	14.714	.15	99	225	99	2.0	
110	40	704.796	704.796	13.243	.12	99	250	99	2.0	
115	45	706.240	706.240	13.243	.12	99	250	99	2.0	
			TOTALS:	158.246	1.44	1188	MAX VACC =			
TOTAL Cu Ft.			TOTALS:	328.984	3.17	2366	AVG. BP:			

METER BOX DATA SHEET PAGE # 2

Page: 2 of 2

UNIT: Country Stoves 5210 RUN: 3 DATE: 10-15-03

Meter Box: SH Y Factor: .981

Leak checks: 15 " Hg @ .001 cfm _____ " Hg @ _____ cfm

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

Inject SO₂ @ 100 cc/min. Nozzle: Probe @ 3/8" od Initial Volume: 1.500

ROTO PRESS: <u>.16</u>			SAMPLING RATIO: <u>47</u>		: 1		BP: <u>29.78</u>		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1650	707.684	707.684	13.288	.13	99	250	99	2.0
125	55	709.123	709.123	13.288	.13	99	250	99	2.0
130	1700	710.562	710.562	13.288	.13	99	250	99	2.0
135	05	712.001	712.001	14.764	.16	99	225	99	2.0
140	10	713.600	713.600	13.288	.13	99	250	99	2.0
145	15	715.039	715.039	13.288	.13	99	250	99	2.0
150	20	716.478	716.478	13.288	.13	99	250	99	2.0
155	25	717.917	717.917	13.288	.13	99	250	99	2.0
160									
165									
170									
175									
ROTO PRESS:			TOTALS:		107.780	1.07	792	BP.:	
180									
185									
190									
195									
200									
205									
210									
215									
220						3158			
225				436.764	4.24	99			
230									
235									
			TOTALS:					MAX VACC =	
TOTAL Cu Ft. <u>45.917</u>			TOTALS:		13.649	.133	(559)	AVG. BP: <u>29.71</u>	

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT: COUNTRY STOVES-S21A RUN: 3 DATE: 10/15/03

SCALE CHECK	LEVEL	ZEROED
INITIAL:	✓	✓
FINAL:		

SCALE	WEIGHT
295.0 g	295.0
590.0 g	590.0
885.0 g	885.0

	#1	#2	#3	#4
IMPINGER				
FINAL WT	672.7	591.7	485.4	886.7
INITIAL WT	619.8	586.2	483.7	878.6
NET WT GRAMS	52.9	5.5	1.7	8.1

TOTAL CATCH: 68.2 GRAMS H₂O

FRONT HALF

FILTER #	177F	
FINAL WT g	.7637	✓
INITIAL WT g	.6941	✓
NET WT g	.0696	✓

BEAKER #	136
DESC.	ACETONE
FINAL WT g	107.1063
INITIAL WT g	107.0840
NET WT g	.0223
VOL. DESC. ml	90

BACK HALF

FILTER #	177B	
FINAL WT g	.4393	✓
INITIAL WT g	.4309	✓
NET WT g	.0084	✓

BEAKER #	137	138	139	140	
DESC.	ACETONE	METHCHLOR	H ₂ O	H ₂ O	
FINAL WT g	104.2034	105.2537	104.4124	106.9702	
INITIAL WT g	104.1651	105.2450	104.4055	106.9640	
NET WT g	.0383	.0087	.0069	.0062	.0131
VOL. DESC ml	140	75	150	145	(295)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : _____ Date : 05/12/2003 Time : 1215 By : DKW
 Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : ZB921
 Back Size : 8.2 cm Lot No. : ZB911

DATE: 05-15-03		BY: BKW		DATE: 05-16-03		BY: BKW		DATE: _____		BY: _____	
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME					
171F	.6931	1133	(.6931)	0942	HEARTHSTONE-TRIBUTE	R-2					
172F	.6967	1134	(.6966)	0943	" "	R-3					
173F	.6934	1135	(.6935)	0944	" "	R-4					
174F	.6998	1136	(.6997)	0945	" "	R-5					
175F	.6955	1137	(.6955)	0946	COUNTRY STOVES-	S210 R#1					
176F	.6973	1137	(.6972)	0946	" "	R-2					
177F	.6943	1138	(.6941)	0947	" "	R-3					
178F	.6911	1139	(.6912)	0948	" "	R-4					
179F	.6963	1140	(.6964)	0949							
180F	.6931	1141	(.6931)	0950							

171B	.4319	1151	(.4320)	0958	HEARTHSTONE-TRIBUTE R-2	
172B	.4326	1151	(.4325)	0959	" "	R-3
173B	.4259	1152	(.4260)	1000	" "	R-4
174B	.4310	1153	(.4307)	1001	" "	R-5
175B	.4282	1154	(.4284)	1001	COUNTRY STOVES-S210 R#1	
176B	.4238	1155	(.4239)	1002	" "	R-2
177B	.4311	1156	(.4309)	1003	" "	R-3
178B	.4351	1157	(.4350)	1004	" "	R-4
179B	.4299	1158	(.4300)	1005		
180B	.4311	1158	(.4309)	1005		

Checked by: G. W. Wainwright Date: 5-16-03 Time: 1241

SCALE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	DB	% RH
05-15	1130	DKW	78	46
05-16	0930	DKW	73	45

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: ⁰⁹ Date: 09/18/2003 Time: 0900 By: DKW

BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
126	105.7690	0838	105.7694	1013	COUNTRY STOVES-S210 R#1	
127	104.0768	0839	104.0771	1014		
128	105.6108	0840	105.6109	1015		
129	106.4315	0841	106.4320	1016		
130	106.5054	0843	106.5058	1018		
131	106.8471	0844	106.8475	1019	COUNTRY STOVES-S210 R#2	
132	105.3860	0845	105.3862	1020		
133	106.5070	0846	106.5067	1021		
134	107.6923	0847	107.6926	1023		
135	104.5961	0848	104.5958	1024		
136	107.0835	0849	107.0840	1025	COUNTRY STOVES-S210 R#3	
137	104.1653	0850	104.1651	1027		
138	105.2454	0851	105.2450	1028		
139	104.4051	0852	104.4055	1029		
140	106.9637	0853	106.9640	1031		
141	102.2830	0854	102.2833	1032	COUNTRY STOVES-S210 R#4	
142	107.8136	0855	107.8140	1033		
143	105.5725	0856	105.5723	1035		
144	106.3813	0857	106.3817	1036		
145	101.5218	0858	101.5221	1037		
146	101.3692	0859	101.3694	1039		
147	106.9572	0860	106.9574	1040		
148	104.7573	0861	104.7577	1041		
149	107.5469	0862	107.5472	1042		
150	106.7053	0863	106.7055	1044		

SCALE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	DB	% RH	Checked by:
09/24	0835	DKW	75	47	Cp Winkler
09/25	1010	DKW	76	49	
					Date: 9-25-03
					Time: 1150

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT: *COUNTRY STOVES - S210* RUN: *3* DATE: *10/15/03* Page: *1* of *1*

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
136	10/16	0845	<i>RL</i>	107.1084	10/17	1617	<i>RL</i>	107.1074	10/19	1227	<i>RL</i>
				(107.1063)	10/21	1324	<i>RL</i>	(104.2034)	10/19	1228	<i>RL</i>
137	10/16	1120	<i>RL</i>	104.2037	10/17	1618	<i>RL</i>				
138	10/16	1120	<i>RL</i>	105.2558	10/17	1626	<i>RL</i>	105.2547	10/19	1229	<i>RL</i>
				(105.2537)	10/21	1325	<i>RL</i>				
139	10/16	0845	<i>RL</i>	104.4143	10/17	1621	<i>RL</i>	104.4131	10/19	1230	<i>RL</i>
				(104.4124)	10/21	1326	<i>RL</i>				
140	10/16	0845	<i>RL</i>	106.9705	10/17	1622	<i>RL</i>	(106.9702)	10/19	1231	<i>RL</i>

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
177F	10-15	1800	<i>Sp</i>	.7641	10/15	2119	<i>Nm</i>	.7635	10/17	1623	<i>RL</i>
177B	10-15	1800	<i>Sp</i>	.4403	10/15	2120	<i>Nm</i>	.4394	10/17	1624	<i>RL</i>

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	10/15	2105	<i>RL</i>	77	49
2	10/17	1600	<i>RL</i>	78	48
3	10/19	1210	<i>RL</i>	78	48
4	10/20	1520	<i>RL</i>	78	45
5	10/21	1320	<i>RL</i>	78	49

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 02-24-2003 Through 06-18-2003	Scale: Sartorius	Model: A 120 S	SN: 37010004
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100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9998	10.000	1.0000	.0999	AKL	02-24	1055	74	44
99.9997	9.9998	1.0001	.0999	AKL	02-25	1700	77	45
100.0000	10.0001	1.0000	.0998	AKL	03-01	1010	71	44
99.9997	10.0001	.9998	.0999	AKL	03-02	1420	75	45
99.9998	10.0000	.9999	.1000	AKL	03-03	1205	76	45
99.9998	10.0000	1.0000	.1000	AKL	03-03	2005	77	47
100.0000	10.0001	1.0001	.0999	AKL	03-04	1035	75	47
99.9996	10.0001	1.0000	.0999	AKL	03-05	0945	71	47
99.9997	10.0001	1.0000	.1000	AKL	03-06	1340	74	46
99.9998	9.9999	1.0000	.0998	AKL	03-07	2050	76	45
99.9998	9.9999	1.0000	.0999	AKL	03-08	1150	77	45
99.9997	9.9998	1.0000	.1000	AKL	03-09	1350	76	45
99.9998	10.0000	.9999	.1000	AKL	03-10	1220	77	47
99.9997	9.9999	1.0000	.1000	AKL	03-18	1940	77	46
99.9997	9.9999	1.0000	.0999	AKL	03-20	2145	74	45
99.9998	10.0000	1.0000	.0998	AKL	03-22	1725	76	47
99.9997	10.0000	.9999	.1000	AKL	03-23	1405	77	47
99.9998	9.9998	.9999	.0999	AKL	03-24	1450	74	44
100.0000	9.9998	1.0000	.0998	AKL	03-25	1120	75	45
99.9998	10.0000	.9999	.0999	AKL	04-30	2300	75	47
99.9997	10.0001	.9999	.1000	AKL	05-02	1130	77	49
99.9998	9.9998	1.0000	.0999	AKL	05-06	2135	77	46
99.9997	9.9999	1.0001	.0999	AKL	05-09	0715	77	45
99.9998	10.0000	.9999	.0999	AKL	05-10	1435	78	47
99.9998	9.9999	1.0000	.0998	AKL	05-11	1210	77	46
99.9999	10.0001	.9999	.0999	AKL	05-12	0940	76	45
10.0001	10.0000	.9999	.1000	AKL	05-13	0910	77	46
99.9999	10.0001	1.0000	.0999	AKL	05-15	1120	78	46
99.9997	9.9999	1.0000	.0999	AKL	05-16	0930	73	45
100.0001	10.0000	.9999	.0999	AKL	05-17	1105	74	46
100.0000	9.9999	1.0000	.1000	AKL	05-18	1550	77	48
99.9997	10.0000	.9999	.0999	AKL	06-04	1025	76	46
99.9998	9.9999	1.0000	.0999	AKL	06-06	1035	78	49
99.9998	9.9999	1.0000	.0999	AKL	06-12	0950	73	43
99.9997	10.0002	1.0000	.0998	AKL	06-13	2115	78	46
99.9998	10.0000	1.0000	.0999	AKL	06-14	1110	78	46
99.9997	9.9999	1.0000	.1000	AKL	06-15	1110	78	47
99.9998	10.0001	1.0000	.1001	AKL	06-17	0905	78	48
99.9998	10.0000	.9999	.1000	AKL	06-18	1025	78	47

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 06-19-2003 Through 10-20-2003	Scale: Sartorius	Model: A 120 S	SN: 37010004
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100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0000	0.9999	.1001	BZ	06/19	0955	77	48
100.0000	10.0000	1.0000	.0999	BZ	06/19	1040	75	48
99.9998	9.9998	1.0000	.0999	BZ	07/23	0840	78	47
99.9997	9.9998	.9999	.0998	BZ	07/24	2200	78	48
99.9997	9.9999	.9999	.0997	BZ	07/25	0845	76	47
99.9999	10.0001	1.0000	.0999	BZ	07/26	1040	78	49
99.9997	9.9998	1.0000	.0998	BZ	07/27	1135	77	48
99.9999	10.0000	1.0000	.0999	BZ	07/29	2045	78	48
99.9997	9.9999	.9999	.0999	BZ	07/30	2100	77	48
99.9998	9.9998	.9999	.0999	BZ	08/01	1205	77	47
100.0000	10.0000	.9999	.0998	BZ	08/28	0915	74	49
99.9999	10.0000	1.0000	.0997	BZ	08/29	0715	78	46
99.9997	10.0001	.9998	.0997	BZ	09/02	0930	77	48
99.9997	10.0000	.9999	.0999	BZ	09/03	0815	77	48
99.9999	9.9999	1.0000	.1000	BZ	09/04	0855	78	49
99.9998	9.9999	1.0000	.0999	BZ	09/05	1110	78	48
99.9997	10.0000	.9998	.0998	BZ	09/06	1940	78	49
99.9997	9.9999	1.0000	.1000	BZ	09/07	1235	77	48
99.9997	9.9998	.9999	.0999	BZ	09/08	1025	76	47
99.9998	9.9999	1.0000	.0999	BZ	09/09	0915	78	47
99.9998	10.0000	1.0000	.1000	BZ	09/16	1030	76	48
99.9999	10.0001	1.0000	.1000	BZ	09/17	1145	77	46
99.9997	9.9999	.9999	.1000	BZ	09/24	0835	75	47
99.9997	10.0000	1.0000	.0999	BZ	09/25	1010	76	49
100.0000	10.0001	1.0000	.0999	BZ	09/30	1115	75	47
99.9997	9.9998	.9999	.1000	BZ	10/02	0955	77	49
99.9997	9.9998	1.0000	.0999	BZ	10/03	0850	77	49
99.9997	9.9999	.9999	.1000	BZ	10/04	1805	77	46
99.9997	9.9998	.9999	.0998	BZ	10/05	1555	77	49
99.9999	10.0000	1.0000	.0999	BZ	10/06	1105	77	46
99.9999	9.9999	1.0000	.1000	BZ	10/07	2020	77	46
99.9999	10.0000	.9999	.1000	BZ	10/08	1015	74	47
99.9999	9.9999	1.0001	.0998	BZ	10/10	1830	75	47
99.9999	10.0000	.9999	.0998	BZ	10/13	0945	78	49
99.9998	9.9999	1.0000	.1000	BZ	10/14	1900	78	49
100.0000	9.9998	.9999	.0999	BZ	10/15	2105	77	49
99.9999	9.9999	1.0000	.1000	BZ	10/17	1600	78	48
99.9998	10.0001	.9999	.1000	BZ	10/19	1210	78	48
99.9998	9.9999	1.0000	.0999	BZ	10/20	1520	78	49

SCALE QA SHEET

[illegible]

BLANK PROCESSING DATA SHEET # 5

UNIT: COUNTRY STOVES-8210 RUN: 3 DATE: 10/15/03

DATE BLANKS DONE: 10/13/03

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	108.9015	106.3075	106.9665
TARE WEIGHT	108.8996	106.3060	106.9644
NET WEIGHT	.0019 ✓	.0015 ✓	.0021 ✓

TARE BEAKERS INTO DESC: TIME: 1635 DATE: 10/05/03

DATE: 10/07 BY: B DATE: 10/08 BY: B DATE: 10/09 BY: B

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8999	2038	108.8996	1021	✓	
B	106.3062	2039	106.3060	1022	✓	
C	106.9646	2040	106.9644	1023	✓	

FINAL BEAKERS INTO DESC: TIME: 0820 DATE: 10/09/03

DATE: 10/10 BY: B DATE: 10/13 BY: B DATE: 10/15 BY: B

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9013	0833	108.9015	0947	✓	
B	106.3070	0834	106.3075	0948	✓	
C	106.9664	0835	106.9665	0949	✓	

TARE QC

DATE	TIME	BY	WB	DB	%
10/07	2020	B	✓	77	46
10/08	1015	B	✓	74	47

FINAL QC

DATE	TIME	BY	WB	DB	%
10/10	0820	B	✓	75	47
10/13	0945	B	✓	78	49

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: COUNTRY STORES-S210 RUN: 3 DATE: 10/15/03

BLANK AUDIT: BY: C. Wadington DATE: 10-14-03

BLANK CALCULATIONS

Acetone: .0019 g ÷ 200 ml = .000010 g/ml ✓
 Dichloromethane: .0015 g ÷ 75 ml = .000020 g/ml ✓
 Distilled Water: .0021 g ÷ 200 ml = .000011 g/ml ✓

FRONT HALF CATCH

FILTERS: .0696 g - 1 (# of Filters) (.0000 g) Blank Value / Filter = .0696 g ✓
Total Catch

BEAKERS: .0223 g - 90 ml Acetone (.000010 g) Blank Value / ml Acetone = .0214 g ✓
Total Catch

TOTAL FRONT HALF CATCH: .0910 g ✓

BACK HALF CATCH

FILTERS: .0084 g - 1 (# of Filters) (.0000 g) Blank Value / Filter = .0084 g ✓
Total Catch

BEAKERS: Acetone: .0383 g - 140 ml Acetone (.000010 g) Blank Value / ml Acetone = .0369 g ✓
Total Catch

Extract: .0087 g - 75 ml Dichloromethane (.000020 g) Blank Value / Dichloromethane = .0072 g ✓
Total Catch

Water: .0131 g - 295 ml Water (.000011 g) Blank Value / Water = .0099 g ✓
Total Catch

TOTAL BACK HALF CATCH: .0624 g ✓

TOTAL CATCH: .1534 g ✓

% FRONT HALF: 59.3 % ✓
 (00.0)

CALCULATIONS DATA SHEET # 7

UNIT: COUNTRY STORES - S210 RUN: 3 DATE: 10/15/03

$$1) Vm (std) = \frac{(45.917 Vm) (17.64) (.98/mcf) (29.71" Hg + \frac{.133" H_2O}{13.6})}{(559 TmA)} = \frac{42.2450}{000.0000} dscf$$

$$2) Vw (std) = (.04707) (\underline{68.2} \text{ ml H}_2\text{O}) = \frac{3.2102}{00.0000} scf$$

$$3) Asw = \frac{(\underline{3.2102} \text{ scf} + \underline{42.2450} \text{ dscf})}{(\underline{3.2102} \text{ scf})} = \frac{.0706}{.0000} Bws \times 100 = \frac{7.0623}{00.0000} \% H_2O$$

$$4) Cs = \frac{(\underline{.1534} \text{ g.})}{(\underline{42.2450} \text{ dscf})} (\underline{15.43}) = \frac{.0560}{0.0000} \text{ gr / dscf}$$

$$5) \text{ Estimated g / hr} = \frac{(\underline{.1534} \text{ g.})}{(\underline{42.2450} \text{ dscf})} (\underline{13.649} \text{ dscfm}) (60) = \frac{2.9737}{00.0000} \text{ g / hr}$$

Vm = total cubic feet pulled on meter box during test mcf = meter correction factor (Y factor) of meter box used for test " Hg = average barometric pressure during test " H₂O = average delta H for test TmA = average meter temperature for test in degrees Absolute ml H₂O = total water caught during test g. = total particulate catch for test dscfm = average stack flow during test	(p. 2) (p. 2) (p. 2) (p. 2) (p. 2) (p. 3) (p. 6) (p. 2)	(000.000 Vm) (0.000 mcf) (00.00 " Hg) (.000 " H₂O) (000 TmA) (000.0 ml H₂O) (00.0000 g.) (00.000 dscf)
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TEST DATA SHEET # 8

UNIT: COUNTRY STOVES-S210 RUN: 3 DATE: 10/15/03

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

Wet Bulb / Dry Bulb Pre: WB: 66 DB: 82 = 42 % RH 1.6 % H₂O

Post: WB: 63 DB: 79 = 40 % RH 1.4 % H₂O

Average: 41.0 % RH 1.50 % H₂O

Empty Stove Weight (lbs): _____ w/ stack & oil seal: Wet: _____ Dry: 458.9

Kindling Weight (lbs): Paper: .2 Wood: 5.6

Preburn Fuel Weight: 17.6 + 18.1 + 16.0 Total: 51.7

Kindling & Preburn Fuel Weight (wood only) (lbs): Total: 57.3

Coal Bed Wt Range (lbs): 4.0 - 3.2 Scale: 462.9 - 462.1

Upper: .25 x fuel weight: Always round DOWN to nearest tenth
Lower: .20 x fuel weight: Always round UP to nearest tenth

Actual Coal Bed Weight: 3.9

Maximum Coal Bed Removal (lbs): $(\frac{4.0}{\text{Upper}} + \frac{3.2}{\text{Lower}}) \div 2 \cdot .25 = .9$ round down to nearest tenth

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

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" x 4"	16.5	3	7.6	47.5
4" x 4"	16.5	2	8.4	52.5

Test Fuel Weight: 16.0 lbs

Estimated Dry Burn Rate: $\frac{16.0 - (16.0 \times .18220)}{2.2046} \times \frac{60}{155} = 2.298$ kg / hr

Estimated BTU's/hr: $19,140 \times \frac{63}{100} \times \frac{2.298}{\text{DBR}} = 27,703.8$ BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit: COUNTRY STOVES - S210 Run: 3 Date: 10/15/03

FIRE STARTED: 1020

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 25 sec.

TEST:

DOOR wide open during loading 0 min. 55 sec.

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

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

FAN:

ON / OFF during warm-up

ON / OFF first 5 minutes of test

Fan speed set at High

ON / OFF during preburn

ON / OFF balance of test run

WOOD DATA:

KINDLING: A mix of the grades listed below:

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

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

All Grades WCLB rules:

WARM UP INFORMATION:

All pre-burn / warm up fuel pieces were either 15 or 15 inches.

1st warm up / pre-burn fuel charge (17.6 lbs.) added at 1035

2nd warm up / pre-burn fuel charge (18.1 lbs.) added at 1200

3rd warm up / pre-burn fuel charge (16.0 lbs.) added at 1337

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 : COUNTRY STOVES - S210 Run : 3 Date : 10/15/03

Room Temperature : 70 °F Correction Factor : 0

Uncorrected Values are corrected for room temperature : Yes No ✓

Time Test Fuel moisture reading taken : 1345

Calibration Checks : X ✓ Y ✓ 12.0 12.1 22.0 22.1

pc #	Dimen.	Use	TOP		BOTTOM		SIDE		Average Corrected
			Uncor.	Cor.	Uncor.	Cor.	Uncor.	Cor.	
1	2"x4"x8'	K	14.5	15.5	14.0	14.9	14.5	15.5	15.300
2									
3									
4	2"x4"x8'	P	18.0	19.2	18.0	19.2	18.0	19.2	19.200
5	2"x4"x8'	P	18.5	19.8	18.0	19.2	18.0	19.2	19.400
6	2"x4"x8'	P	20.0	21.4	21.5	23.1	21.5	23.1	22.533
7	2"x4"x8'	P	19.0	20.3	19.0	20.3	19.0	20.3	20.300
8	2"x4"x8'	P							81.433
9									
10									
11									
12	2"x4"x16.5"	T	18.5	19.8	18.5	19.8	18.5	19.8	19.800
13	2"x4"x16.5"	T	22.5	24.1	22.5	24.1	23.0	24.7	24.300
14	2"x4"x16.5"	T	22.5	24.1	22.5	24.1	22.5	24.1	24.100
15	4"x4"x16.5"	T	20.5	22.0	20.0	21.4	20.5	22.0	21.800
16	4"x4"x16.5"	T	20.0	21.4	20.0	21.4	20.0	21.4	21.400
17									111.400
18									
19									
20	Spacers	T	19.5	20.9	21.0	22.5	21.0	22.5	21.967

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	15.300 %	20.358 %	22.280 %
Wet Moisture % :	13.270 %	16.915 %	18.220 %

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

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

GAS DATA SHEET #12

WEIGHT: 462.8

DATE: 10/15/03

UNIT: COUNTRY STOVES - S210

RUN: 3

PAGE: / OF /

UNIT: COUNTRY STUDIES - JAXTU						RUN: 1	PAGE: 1					
TIME	SCALE	FUEL	DROP	V.	CO ₂	V.	O ₂	V.	CO	STATIC	SO:PPM	
0 1450	478.8	16.0	-	6.8	.271	.540	13.5	.058	.58	-0.58	225	
5 55	477.8	15.0	1.0	13.4	.538	.290	7.2	.014	.14	-0.67	175	
10 1500	476.5	13.7	1.3	12.3	.493	.338	8.4	.006	.06	-0.68	225	
15 05	475.3	12.5	1.2	13.7	.548	.284	7.1	.004	.04	-0.70	225	
20 10	474.2	11.4	1.1	15.5	.621	.209	5.2	.009	.09	-0.72	250	
25 15	473.0	10.2	1.2	16.0	.642	.180	4.5	.029	.29	-0.72	250	
30 20	471.8	9.0	1.2	13.5	.540	.291	7.3	.007	.07	-0.70	250	
35 25	470.8	8.0	1.0	10.0	.400	.430	10.7	.009	.09	-0.68	225	
40 30	470.0	7.2	.8	13.4	.539	.292	7.3	.006	.06	-0.68	250	
45 35	469.0	6.2	1.0	13.8	.555	.276	6.9	.006	.06	-0.70	250	
50 40	468.1	5.3	.9	9.9	.398	.433	10.8	.008	.08	-0.67	250	
55 45	467.5	4.7	.6	8.3	.331	.498	12.4	.012	.12	-0.65	250	
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-8.15	*****	
60 1550	467.0	4.2	.5	7.0	.282	.535	13.3	.042	.42	-0.63	250	
65 55	466.6	3.8	.4	6.2	.248	.562	14.0	.060	.60	-0.60	275	
70 1600	466.2	3.4	.4	6.4	.255	.557	13.9	.055	.55	-0.57	275	
75 05	465.7	2.9	.5	7.0	.280	.535	13.4	.046	.46	-0.59	275	
80 10	465.3	2.5	.4	6.7	.267	.553	13.8	.034	.34	-0.59	250	
85 15	464.9	2.1	.4	6.3	.252	.567	14.1	.037	.37	-0.57	250	
90 20	464.7	1.9	.2	5.7	.227	.588	14.7	.048	.48	-0.55	250	
95 25	464.4	1.6	.3	5.6	.224	.591	14.8	.046	.46	-0.54	250	
100 30	464.2	1.4	.2	5.5	.220	.596	14.9	.045	.45	-0.53	225	
105 35	464.0	1.2	.2	5.3	.212	.599	15.0	.056	.56	-0.51	225	
110 40	463.8	1.0	.2	4.9	.195	.617	15.4	.055	.55	-0.50	250	
115 45	463.7	.9	.1	4.7	.188	.622	15.5	.060	.60	-0.50	250	
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-6.68	*****	
120 1650	463.6	.8	.1	5.2	.207	.604	15.1	.056	.56	-0.49	250	
125 55	463.5	.7	.1	5.4	.216	.597	14.9	.051	.51	-0.48	250	
130 1700	463.3	.5	.2	5.2	.207	.602	15.0	.062	.62	-0.47	250	
135 05	463.2	.4	.1	5.0	.199	.608	15.2	.068	.68	-0.47	225	
140 10	463.1	.3	.1	4.5	.182	.621	15.5	.077	.77	-0.46	250	
145 15	463.0	.2	.1	4.5	.179	.618	15.4	.092	.93	-0.46	250	
150 20	462.9	.1	.1	4.4	.178	.617	15.4	.096	.97	-0.46	250	
155 25	462.8	0	.1	4.4	.178	.618	15.4	.093	.94	-0.45	250	
160 30												
165 35										-3.74		
170 40												
175 45											2.32 ✓	
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-1.857	*****	
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-0.58	*****	

PREBURN DATA SHEET #13

UNIT: COUNTRY STOVES - S210

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DATE: 10/15/03 PAGE: 1

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PAGE

[illegible]

RUN 3

COUNTRY STOVES, INC. - S210

10/15/2003

TEMPERATURE DATA SHEET #14

TEST TIME	155		
STACK AVG	404	TOP AVG	265
		LT SIDE AVG	423
BACK AVG	188	RT SIDE AVG	440
		BOTTOM AVG	333
FIREBOX AVG #####		SEC/CAT AVG	1069
		AMBIENT AVG	74

END	283.5	
START	383.0	
	-99.5	DELTA T

CIRCLE: LOSS / GAIN

Time	Stack	Top	LT Side	Back	Rt Side	Bottom	Firebox	Sec/Cat	Ambient	Tube Furn	Smpl Box	Smpl Out	C-Gas Box	C-Gas Out	SO2 Out
0	378	275	509	212	513	406	#####	1070	75	1321	237	65	247	34	34
5	492	301	493	344	507	407	#####	1254	74	1324	235	53	248	35	35
10	522	318	471	228	478	406	#####	1250	74	1327	237	49	249	36	36
15	549	338	451	204	466	399	#####	1261	74	1329	239	52	248	37	37
20	591	366	446	191	452	391	#####	1219	74	1331	237	52	247	37	38
25	603	396	443	186	449	380	#####	1399	75	1336	236	52	245	37	38
30	561	409	445	178	447	372	#####	1420	74	1340	235	52	248	37	39
35	533	397	451	175	449	363	#####	1314	74	1343	236	53	246	38	37
40	510	368	454	173	451	355	#####	1350	75	1345	237	54	246	39	37
45	534	361	461	169	450	348	#####	1392	74	1334	237	54	245	39	36
50	508	358	467	172	451	341	#####	1280	74	1327	236	54	246	37	36
55	475	339	472	172	451	335	#####	1186	74	1321	236	54	247	37	36
60	437	317	467	172	449	330	#####	1063	73	1323	237	54	248	35	36
65	400	288	457	174	446	325	#####	996	74	1325	238	54	246	36	36
70	382	265	447	174	440	320	#####	994	72	1327	237	54	244	36	36
75	386	248	437	173	440	317	#####	1056	72	1327	235	54	242	36	36
80	391	240	429	172	440	312	#####	1115	72	1327	235	54	241	36	36
85	373	233	422	175	441	308	#####	1021	73	1326	236	54	243	36	36
90	353	225	416	177	438	303	#####	979	73	1326	236	55	243	36	36
95	342	216	407	177	434	301	#####	958	73	1326	236	55	243	36	36
100	333	207	399	177	432	299	#####	942	72	1325	235	55	242	36	36
105	325	200	391	177	431	299	#####	939	72	1324	234	55	241	36	36
110	314	194	383	176	427	299	#####	898	70	1323	234	55	240	35	35
115	304	188	376	177	427	300	#####	870	71	1325	234	55	241	35	35
120	302	182	370	178	422	301	#####	883	70	1326	234	55	241	35	35
125	300	180	368	184	422	303	#####	910	74	1327	234	55	242	35	35
130	297	181	369	188	421	304	#####	920	75	1327	234	55	243	35	36
135	293	181	369	191	418	306	#####	897	75	1326	234	56	243	35	36
140	290	180	369	190	411	307	#####	862	77	1326	234	54	244	36	35
145	285	178	366	190	403	308	#####	850	76	1325	235	54	244	35	34
150	286	175	363	187	395	308	#####	829	75	1326	235	54	244	35	35
155	282	173	359	188	390	307	#####	827	75	1326	235	54	244	35	35

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 10/15/03 Analyte : CO₂ (15-1)
 Unit : COUNTY STOVES - 8210 Run # : 3
 Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % CO₂ Cyl. Press. : 480 PSI
 Certified by : AIR LIQUIDE Date : 02-20-02
 Span Cyl. # : CC-3131 Conc. : 12.40 % CO₂ Cyl. Press. : 1025 PSI
 Certified by : AIR LIQUIDE Date : 03-13-03
 Analyzer : Make : HORIBA Model : PIR-2000 SN : 407069
 Range : 0 - 25.0 % CO₂ Analyzer Output : 0 - 1.0 v.
 Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % CO₂
 EPA Control Limits = $\pm 2.5\%$ of 25.0 % CO₂ = ± 0.625 % CO₂
 Method 28 A = $\pm .2$ % of 25.0 % CO₂ = $\pm .05$ % CO₂

PRE RUN Audit : by : D. Whittington Time : 1325 Temp : 72 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	.012	+0.012	+0.49
SPAN	49.6	.496	12.40	49.5	.495	12.347	-0.053	-2.12

POST RUN Audit : by : D. Whittington Time : 1745 Temp : 73 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	.037	+0.037	+1.149
SPAN	49.6	.496	12.40	49.8	.498	12.422	+0.022	+0.88

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

ZERO / SPAN CHECK DATA SHEET #15-2

Date: 10/15/03 Analyte: O₂ (15-2)
 Unit: COUNTRY STOVES-S210 Run #: 3
 Zero Cyl. #: 042TAC 2-A Conc.: 0.00 % O₂ Cyl. Press.: 480 PSI
 Certified by: AIR LIQUIDE Date: 02-20-02
 Span Cyl. #: CC-3131 Conc.: 12.40 % O₂ Cyl. Press.: 1025 PSI
 Certified by: AIR LIQUIDE Date: 03-13-03
 Analyzer: Make: TELEDYNE Model: 320 A SN: 37400
 Range: 0 - 25.0 % O₂ Analyzer Output: 0 - 1.0 v.
 Flow: 1.5 SCFH Measured by: Rotameter

EPA Span Value = 25.0 % O₂
 EPA Control Limits = $\pm 2.5\%$ of 25.0 % O₂ = $\pm 0.625\%$ O₂
 Method 28 A = $\pm .2\%$ of 25.0 % O₂ = $\pm .05\%$ O₂

PRE RUN Audit: by: D. Wadsworth Time: 1325 Temp: 72 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	.025	+ .025	+ .101 ✓
SPAN	12.50	.500	12.50	12.50	.500	12.476	- .024	- .094 ✓

POST RUN Audit: by: D. Wadsworth Time: 1745 Temp: 73 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	.025	+ .025	+ .101 ✓
SPAN	12.50	.500	12.50	12.50	.501	12.501	+ .001	+ .006 ✓

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

ZERO / SPAN CHECK DATA SHEET #15-3

Date: 10/15/03 Analyte: CO (15-3)
 Unit: COUNTRY STOVES - S210 Run #: 3
 Zero Cyl. #: 042TAC 2-A Conc.: 0.00 % CO Cyl. Press.: 480 PSI
 Certified by: AIR LIQUIDE Date: 02-20-02
 Span Cyl. #: CC-3131 Conc.: 12.40 % CO Cyl. Press.: 1025 PSI
 Certified by: AIR LIQUIDE Date: 03-13-03
 Analyzer: Make: HORIBA Model: PIR-2000 SN: 408005
 Range: 0 - 10.0 % CO Analyzer Output: 0 - 1.0 v.
 Flow: 1.5 SCFH Measured by: Rotameter

EPA Span Value = 10.0 % CO
 EPA Control Limits = $\pm 2.5\%$ of 10.0 % CO = ± 0.25 % CO
 Method 28 A = $\pm .2\%$ of 10.0 % CO = $\pm .02$ % CO

PRE RUN Audit: by: D. Wadlington Time: 1325 Temp: 72 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.001	+ .001	+ .012 ✓
SPAN	50.2	.502	5.02	50.1	.501	5.029	+ .009	+ .090 ✓

POST RUN Audit: by: D. Wadlington Time: 1745 Temp: 73 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	.011	+ .011	+ .113 ✓
SPAN	50.2	.502	5.02	50.0	.500	5.019	- .001	- .011 ✓

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

ZERO / SPAN CHECK DATA SHEET #15-4

Date: 10/15/03 Analyte: SO₂ (15-4)
 Unit: COUNTRY STOVES-S210 Run #: 3
 Zero Cyl. #: 042TAC 2-A Conc.: 0.00 ppm SO₂ Cyl. Press.: 480 PSI
 Certified by: AIR LIQUIDE Date: 02-20-02
 Span Cyl. #: CC62184 Conc.: 1290 ppm SO₂ Cyl. Press.: 850 PSI
 Certified by: AIR LIQUIDE Date: 01-29-01
 Analyzer: Make: HORIBA Model: PIR-2000 SN: 403019
 Range: 0 - 2500 ppm SO₂ Analyzer Output: 0 - 1.0 v.
 Flow: 1.5 SCFH Measured by: Rotameter

EPA Span Value = 2500 ppm SO₂
 EPA Control Limits = $\pm 2.5\%$ of 2500 ppm SO₂ = ± 62.5 ppm SO₂

PRE RUN Audit: by: D. Wadsworth Time: 1325 Temp: 72 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	7.095	+7.095	+284 ✓
SPAN	51.6	.516	1290	51.3	.513	1278.350	-11.650	-466 ✓

POST RUN Audit: by: D. Wadsworth Time: 1745 Temp: 73 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	7.095	+7.095	+284 ✓
SPAN	51.6	.516	1290	51.7	.517	1288.301	-1.699	-068 ✓

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

QUALITY CHECKS DATA SHEET # 16

UNIT : COUNTRY STOVES-S210 RUN : 3 DATE : 10/15/03

Thermocouple Check:

T/C # 1	<u> </u> °F	T/C # 13	<u>60.8</u> °F
T/C # 2	<u> </u> °F	T/C # 14	<u>58.0</u> °F
T/C # 3	<u>58.6</u> °F	T/C # 15	<u>61.0</u> °F
T/C # 4	<u>57.2</u> °F	T/C # 16	<u>49.2</u> °F
T/C # 5	<u>56.8</u> °F	T/C # 17	<u>49.2</u> °F
T/C # 6	<u>56.7</u> °F	T/C # 18	<u>59.0</u> °F
T/C # 7	<u>56.7</u> °F	T/C # 19	<u>57.8</u> °F
T/C # 8	<u>56.4</u> °F	T/C # 20	<u> </u> °F
T/C # 9	<u> </u> °F	T/C # 21	<u> </u> °F
T/C # 10	<u>56.2</u> °F	T/C # 22	<u> </u> °F
T/C # 11	<u>54.3</u> °F	T/C # 23	<u> </u> °F
T/C # 12	<u>63.4</u> °F	T/C # 24	<u> </u> °F

Thermocouple Readout:

Pretest zero and span check and calibration

post test zero and span

% difference

ZERO -1.6 °F Adj. to 0.0 °F

ZERO 1.5 °F Difference .075 %

SPAN 2000.4 °F Adj. to 2000.0 °F

SPAN 2001.2 °F Difference .060 %

Thermocouple Readout Pretest Linearity Check:

0	= <u>0.0</u> °F	200	= <u>200.1</u> °F	400	= <u>399.9</u> °F
600	= <u>599.8</u> °F	800	= <u>799.6</u> °F	1000	= <u>999.7</u> °F
1200	= <u>1199.6</u> °F	1400	= <u>1399.4</u> °F	1600	= <u>1599.4</u> °F
1800	= <u>1799.8</u> °F	2000	= <u>2000.0</u> °F		

Sample Train Leak Check

Pre ✓

Post ✓

C-gas Train Leak Check

Pre ✓

Post ✓

SO₂ Train Leak Check

Pre ✓

Post ✓

Static Gauge Zero Check

Pre ✓

Post X

Scale Check Pre :

472.8 - 462.8 ✓

Post :

472.4 - 462.4 ✓

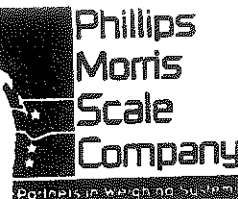
Stack Cleaned Prior to Test Run : YES

NO

X

Calibration Data

INSPECTION CERTIFICATE



934 Elliott Avenue W.
Seattle, WA 98119
Ph#(206)284-6090
Fax#(206)282-6612

CUSTOMER: LOKEE TESTING
ADDRESS: 13235 Prairie Circle
Sumner WA 98390
TECHNICIAN: Patrick McEllan
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 <u>weightronix</u>	_____	PRINTER _____
MODEL <u>WE-110</u>	_____	SCORE BOARD _____
SR# <u>16409</u>	_____	COMPUTER _____
CLASS <u>III</u>	_____	OTHER _____
CAP. <u>1000 lbs</u>	_____	

PRE-TEST	POST-TEST	MANUFACTURER TOLERANCE
<u>Ø</u>	<u>Ø</u>	_____
<u>998.7</u>	<u>499.9</u>	_____
	<u>1000.0</u>	_____

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)

<u>T23-13</u>	<u>T23-14</u>	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____



METROLOGY LABORATORY

Receipt Date: January 29, 2002
 Test Date: February 13, 2002
 Report Date: February 13, 2002

State Test Number: L2017-1
 Group ID: SHOP
 Due Date: February 13, 2004

CALIBRATION REPORT

Phillips Morris Scale Company
 934 Elliott Ave. W
 Seattle, WA 98119-3608
 Contact: Todd Mackie
 Phone: 206-284-6090
 PO Number: 2-2-009237
 SOP: 8

Item(s) Submitted: See Table Below
 Specification: NIST HB 105-1, Class F
 Condition: Good
 Temperature: 21.0 °C
 Pressure: 762.0 mmHg
 Humidity: 35 % RH
 Technician ID: DW

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

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

LABORATORY SERVICES DIVISION
 WEIGHTS AND MEASURES PROGRAM

Dan Wright
 DAN WRIGHT
 STATE METROLOGIST

NVLAP[®]

NVLAP LAB CODE 200446-0

MAR 08 2002

W98MR42-01, 11/98

Page 1 of 1

QUALITY CONTROL SERVICES Inc.

2340 S.E. 11Th. Avenue Portland, Oregon 97214
(503) 236-2712 / FAX:(503) 235-2535

Customer and Contact
Free Testing Labs
1505 Prairie Circle East
Sumner, WA. 98390
Chip Wadington

Report Number: EESPC37010004031104

CERTIFICATE OF CALIBRATION AND TEST RECORD

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location	SOP Used
Balance	Sartorius	A120S	37010004	N/A	Lab	QC004
Units	Readability	Range Calibrated	Tolerance Used	Cal. Date	Last Cal.	Cal. Due
Grams	0.0001	0-100	Factory	11/04/2003	05/15/2003	05/2004

Functional Checks

CORNERLOAD: Test Wt: Tol: 100 0.0003 AS FOUND: Pass: ☒ Fail: ☐ AS LEFT: Pass: ☒ Fail: ☐	LINEARITY: Test Wt: Tol: 50x2 0.0004 AS FOUND: Pass: ☒ Fail: ☐ AS LEFT: Pass: ☒ Fail: ☐	REPEATABILITY: Test Wt: Tol: 100 0.0001 AS FOUND: Pass: ☒ Fail: ☐ AS LEFT: Pass: ☒ Fail: ☐	ENVIRONMENTAL CONDITIONS: ☐ Good ☒ Fair ☐ Poor
--	--	---	--

CALIBRATION DATA

Standard	As Found Instrument	As Left Instrument
100	100.0003	100.0000
70	70.0002	70.0000
50	50.0001	50.0000
20	20.0000	20.0000
10	10.0000	10.0000
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Units	Cal. Date	Cal. Due	Traceable ID#
Weight Set	R.L./Troemner	1MG-25KG	A45	Grams	11/12/2002	11/2003	822/265349-01

Comments / Info Concerning This Calibration:

Permanent Information Concerning This Instrument:

Technician: D. Deleasa

Signature: 

CALIBRATIONS ARE PERFORMED UNDER AMBIENT CONDITIONS USING MANUFACTURER'S OR CUSTOMERS SPECIFICATIONS FOR THE PASS/FAIL RESULTS. RESULTS MAY BE INFLUENCED BY THE AGE OF THE INSTRUMENT AND ENVIRONMENTAL CONDITIONS. CALIBRATION DATA SHOULD BE REVIEWED TO INSURE THAT THE INSTRUMENT IS PERFORMING TO ITS INTENDED ACCURACY. CALIBRATIONS CONFORM TO ISO/IEC GUIDE 25-1990(17025) AND ANSI / NCSL Z540-1-1994 SPECIFICATIONS. INSTRUMENTS LISTED ABOVE WERE CALIBRATED USING STANDARDS TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (N.I.S.T.).

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

Form Number: BA62

Customer Code: EESPC

Rev. Date: 05/13/2003

QUALITY CONTROL SERVICES Inc.

Customer and Contact
Hook Testing Labs
1505 Prairie Circle East
Sumner, WA. 98390
Ship Wadington

2340 S.E. 11Th. Avenue Portland, Oregon 97214
(503) 236-2712 / FAX:(503) 235-2535

Report Number: EESPC37010004030515

CERTIFICATE OF CALIBRATION AND TEST RECORD

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location	SOP Used
Balance	Sartorius	A120S	37010004	N/A	Lab	QC004
Units	Readability	Range Calibrated	Tolerance Used	Cal. Date	Last Cal.	Cal. Due
Grams	0.0001	0-100	Factory	05/15/2003	11/07/2002	11/2003

Functional Checks

CORNERLOAD: Test Wt: Tol: 100 0.0003 AS FOUND: Pass: ☒ Fail: ☐ AS LEFT: Pass: ☒ Fail: ☐	LINEARITY: Test Wt: Tol: 50x2 0.0004 AS FOUND: Pass: ☒ Fail: ☐ AS LEFT: Pass: ☒ Fail: ☐	REPEATABILITY: Test Wt: Tol: 100 0.0001 AS FOUND: Pass: ☒ Fail: ☐ AS LEFT: Pass: ☒ Fail: ☐	ENVIRONMENTAL CONDITIONS: ☐ Good ☒ Fair ☐ Poor
--	--	---	--

CALIBRATION DATA

Standard	As Found Instrument	As Left Instrument
100	100.0003	100.0000
70	70.0002	70.0000
50	50.0001	50.0000
20	20.0001	20.0000
10	10.0000	10.0000
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Units	Cal. Date	Cal. Due	Traceable ID#
Weight Set	R.L./Troemner	1MG-25KG	A45	Grams	11/12/2002	11/2003	822/265349-01

Comments / Info Concerning This Calibration:

Permanent Information Concerning This Instrument:

Technician: D. Deleasa

Signature: 

CALIBRATIONS ARE PERFORMED UNDER AMBIENT CONDITIONS USING MANUFACTURER'S OR CUSTOMERS SPECIFICATIONS FOR THE PASS/FAIL RESULTS. RESULTS MAY BE INFLUENCED BY THE AGE OF THE INSTRUMENT AND ENVIRONMENTAL CONDITIONS. CALIBRATION DATA SHOULD BE REVIEWED TO INSURE THAT THE INSTRUMENT IS PERFORMING TO ITS INTENDED ACCURACY. CALIBRATIONS CONFORM TO ISO/IEC GUIDE 25-1990(17025) AND ANSI / NCSL Z540-1-1994 SPECIFICATIONS. INSTRUMENTS LISTED ABOVE WERE CALIBRATED USING STANDARDS TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (N.I.S.T.).

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Form Number: BA62

Customer Code: EESPC

Rev. Date: 05/13/2003

QUALITY CONTROL SERVICES Inc.

2340 S.E. 11Th. Avenue Portland, Oregon 97214
(503) 236-2712 / FAX:(503) 235-2535

Customer and Contact
Metro Testing Labs
13235 Prairie Circle East
Sumner, WA. 98390
Chip Wadington

Report Number: EESPC37010004021107

CERTIFICATE OF CALIBRATION AND TEST RECORD

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location	SOP Used
Balance	Sartorius	A120S	37010004	N/A	Lab	QC004
Units	Readability	Range Calibrated	Tolerance Used	Cal. Date	Last Cal.	Cal. Due
Grams	0.0001	0-100	Factory	11/07/2002	10/31/2001	05/2003

Functional Checks

CORNERLOAD: Test Wt: Tol: 100 0.0003 AS FOUND: Pass: ☒ Fail: ☐ AS LEFT: Pass: ☒ Fail: ☐	LINEARITY: Test Wt: Tol: 50x2 0.0004 AS FOUND: Pass: ☒ Fail: ☐ AS LEFT: Pass: ☒ Fail: ☐	REPEATABILITY: Test Wt: Tol: 100 0.0001 AS FOUND: Pass: ☒ Fail: ☐ AS LEFT: Pass: ☒ Fail: ☐	ENVIRONMENTAL CONDITIONS: ☐ Good ☒ Fair ☐ Poor
--	--	---	--

CALIBRATION DATA

Standard	As Found Instrument	As Left Instrument
100	100.0004	100.0004
70	70.0003	70.0003
50	50.0002	50.0002
20	20.0001	20.0001
10	10.0000	10.0000
5	5.0000	5.0000
1	1.0000	1.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Units	Cal. Date	Cal. Due	Traceable ID#
Weight Set	R.L./Troemner	1MG-25KG	A45	Grams	12/13/2001	12/2002	2261-1201

Comments / Info Concerning This Calibration:

Permanent Information Concerning This Instrument:

Technician: D. Deleasa

Signature: 

CALIBRATIONS ARE PERFORMED UNDER AMBIENT CONDITIONS USING MANUFACTURER'S OR CUSTOMER'S SPECIFICATIONS FOR THE
FAIL RESULTS. RESULTS MAY BE INFLUENCED BY THE AGE OF THE INSTRUMENT AND ENVIRONMENTAL CONDITIONS. CALIBRATION
D. SHOULD BE REVIEWED TO INSURE THAT THE INSTRUMENT IS PERFORMING TO ITS INTENDED ACCURACY. CALIBRATIONS CONFORM
TO ISO/IEC GUIDE 25-1990(17025) AND ANSI / NCSL Z540-1-1994 SPECIFICATIONS.

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

Form Number: BA62

Customer Code: EESPC

Rev. Date: 03/19/2002

QUALITY CONTROL SERVICES Inc.

2340 S.E. 11Th. Avenue Portland, Oregon 97214
(503) 236-2712 / FAX:(503) 235-2535

Customer and Contact

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

Report Number: EESPC37010004020506

CERTIFICATE OF CALIBRATION AND TEST RECORD

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location	SOP Used
Balance	Sartorius	A120S	37010004	N/A	Lab	QC012
Units	Readability	Range Calibrated	Tolerance Used	Cal. Date	Last Cal.	Cal. Due
Grams	0.0001	0-100	Factory	05/06/2002	10/31/2001	11/2002

Functional Checks

CORNERLOAD: Test Wt: Tol: 100 0.0003 AS FOUND: Pass: ☒ Fail: ☐ AS LEFT: Pass: ☒ Fail: ☐	LINEARITY: Test Wt: Tol: 50x2 0.0004 AS FOUND: Pass: ☒ Fail: ☐ AS LEFT: Pass: ☒ Fail: ☐	REPEATABILITY: Test Wt: Tol: 100 0.0001 AS FOUND: Pass: ☒ Fail: ☐ AS LEFT: Pass: ☒ Fail: ☐	ENVIRONMENTAL CONDITIONS: ☐ Good ☒ Fair ☐ Poor
--	--	---	--

CALIBRATION DATA

Standard	As Found Instrument	As Left Instrument
100	100.0004	100.0000
70	70.0003	70.0000
50	50.0002	50.0000
20	20.0001	20.0000
10	10.0000	10.0000
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Units	Cal. Date	Cal. Due	Traceable ID#
Weight Set	R.L./Troemner	1MG-25KG	A45	Grams	12/13/2001	12/2002	2261-1201

Comments / Info Concerning This Calibration:

Permanent Information Concerning This Instrument:

Technician: D. Deleasa

Signature: *D. Deleasa*

ALL CALIBRATIONS ARE PERFORMED UNDER AMBIENT CONDITIONS USING MANUFACTURER'S OR CUSTOMER'S SPECIFICATIONS FOR THE
FAIL RESULTS. RESULTS MAY BE INFLUENCED BY THE AGE OF THE INSTRUMENT AND ENVIRONMENTAL CONDITIONS. CALIBRATION
DATA SHOULD BE REVIEWED TO INSURE THAT THE INSTRUMENT IS PERFORMING TO ITS INTENDED ACCURACY. CALIBRATIONS CONFORM
TO ISO/IEC GUIDE 25-1990(17025) AND ANSI / NCSL Z540-1-1994 SPECIFICATIONS.

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

Form Number: BA62

Customer Code: EESPC

Rev. Date: 03/19/2002

QUALITY CONTROL SERVICES Inc.

2340 S.E. 11Th. Avenue Portland, Oregon 97214-5306

(503) 236-2712 / FAX: (503) 235-2535

CERTIFICATE OF CALIBRATION

Customer and Contact

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

Report Number: EESPC37010004011031

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location	SOP Used
Balance	Sartorius	A120S	37010004	N/A	Lab	QC012
Units	Readability	Range Calibrated	Tolerance Used	Cal. Date	Last Cal.	Cal. Due
Grams	0.0001	0-100	Factory	10/31/2001	04/30/2001	04/2002

Functional Checks

Cornerload ☒

Linearity 0 - 1/2 - Full Capacity ☒

Reproduceability ☒

CALIBRATION DATA

As Found Instrument	Standard	As Left Instrument
100.0002	100	100.0000
50.0001	50	50.0000
20.0000	20	20.0000
10.0000	10	10.0000
5.0000	5	5.0000
1.0000	1	1.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Units	Cal. Date	Cal. Due	Traceable ID#
Weight Set	R.L./Troemner	5MG-25KG	A45	Grams	12/11/2000	12/2001	A45-2000

Comments / Info Concerning This Calibration:

Permanent Information Concerning This Instrument:

5/00 CUSTOMER REQUESTED SPECIFIC 6 POINT CHECK 100,50,20,10,5,1

Technician: D. Deleasa

Signature: D. Deleasa

CALIBRATIONS ARE PERFORMED UNDER AMBIENT CONDITIONS USING MANUFACTURER'S OR CUSTOMERS SPECIFICATIONS FOR THE PASS/FAIL RESULTS. RESULTS MAY BE INFLUENCED BY THE AGE OF THE INSTRUMENT AND ENVIRONMENTAL CONDITIONS. CALIBRATION DATA SHOULD BE REVIEWED TO INSURE THAT THE INSTRUMENT IS PERFORMING TO ITS INTENDED ACCURACY. CALIBRATIONS CONFORM TO ISO/IEC GUIDE 25-1990(17025) AND ANSI / NCSL Z540-1-1994 SPECIFICATIONS.

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

Thermocouple Calibration Record Semi-Annual

Thermocouples Check against

Reference Thermometer

serial number 9123454

Ice Water Bath

32.0

Boiling Water

212.0

Room Temperature

80.1

Barometric Pressure

30.01

DATE: 5-14-03

TC	Location	Ice Bath Temp	Boiling Water Temp
1	Wet Bulb	32.1	211.9
2	Dry Bulb	32.2	211.2
3	Stack	32.0	211.3
4	Stove Top	32.2	211.8
5	Left Side	32.2	212.0
6	Back	32.1	211.7
7	Right Side	32.2	211.8
8	Bottom	32.1	211.7
9	Firebox	32.0	210.9
10	Secondary/Cat	32.0	211.0
11	Ambient	32.1	210.8
12	Tube Furnace	32.1	212.0
13	Sample Box	32.3	211.9
14	Impinger Out	32.0	211.0
15	C. Gas Box	32.1	211.2
16	C. Gas Out	32.1	210.3
17	SO2 Out	32.2	210.5
18	Upper Ambient	32.1	211.2
19			
20			
21			
22			
23	Calibrator	32.1	210.9
24	Oven	32.1	211.0

Thermocouple Readout Semi-Annual Calibration Data Sheet

Date: 5-14-2003
 Ambient Temperature: 78.7
 Technician: CPW

Thermocouple Number: T/C Readout
 Barometric Pressure: 30.01
 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	φ
212	Boiling Water	211.9	211.9	φ
250	Omega	250.0	249.9	.040
300	Omega	300.0	300.3	-.100
400	Omega	400.0	400.1	.025
500	Omega	500.0	499.0	.200
600	Omega	600.0	599.8	.033
700	Omega	700.0	700.0	φ
800	Omega	800.0	801.3	-.163
900	Omega	900.0	901.0	-.111
1000	Omega	1000.0	1000.3	-.030
1200	Omega	1200.0	1198.8	.100
1400	Omega	1400.0	1399.7	.021
1600	Omega	1600.0	1598.9	.069
1800	Omega	1800.0	1799.6	.022
2000	Omega	2000.0	2000.0	φ

^a Every 50°F for each reference point

^b Type of Calibration System Used

^c $\frac{(\text{reference temperature}) - (\text{thermocouple temperature})}{\text{reference temperature}} \times 100$

TRACEABILITY DOCUMENTATION Semi-Annual

SO₂ INJECTION ROTAMETER, DRY GAS METER AND SLING PSYCHROMETER
THERMOMETERS IN LAB. CHECKED AGAINST FISHER SN 9123454 (NIST).

DATE: 5-14-2003

SO₂ INJECTION ROTAMETER
9123454

FISHER SN

NIST Traceable

Actual	°C = °F	°F
0.0	32.0	32.0
19.8	67.6	67.8
42.0	107.6	107.5
51.6	124.9	125.0

DRY GAS METER THERMOCOUPLES

Actual	°C = °F	5H in	5H out	KK
0.0	32.0	32.2	32.1	32.1
19.0	66.2	66.0	66.1	66.1
41.6	106.9	107.0	106.7	107.0
51.0	123.8	123.5	123.7	123.7

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
33.0	91.4	91.4	91.4
40.8	105.4	105.4	105.4

Conversions =

$$^{\circ}\text{F} = (^{\circ}\text{C} \times 1.8) + 32$$

$$^{\circ}\text{C} = (^{\circ}\text{F} - 32) \div 1.8$$

VANEOMETER CALIBRATION

LoKee Testing Lab uses a Dwyer Model #480 Vaneometer to measure test chamber air velocity. The manufacturer's specifications for accuracy are $\pm 5.0\%$ to 100 FPM and $\pm 10\%$ 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 $\pm 0.001"$ 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: COUNTRY STOVES - 8210 DATE: 10-21-03

TEST DATA

RUN #	1	2	3	4	5	6	7	8	9	10
AVG. ΔH	.138	.145	.133	.159						
MAX VAC	3.0	5.0	3.0	4.0						
Avg. Test Series ΔH:	.144				in H ₂ O					
Audit Dry Gas Meter:	K2				Correction (Y) Factor: 1.002 (mcf)					
Test Dry Gas Meter:	H				Correction (Y) Factor: .981 (mcf)					

AUDIT DATA

		Audit #1	Audit #2	Audit #3
BP		29.84	29.84	29.84
VAC		5.0	5.0	5.0
AUDIT METER:				
VOL.	Final	619.462	624.448	629.443
(Vw)	Initial	613.000	619.462	624.448
	Vol.	6.462	4.986	4.995
TEMP (°F)	Initial	84	84	84
(Tw)	Mid	84	84	85
	Final	84	84	86
(°F / °A)	Avg.	84 (544)	84 (544)	(545)
ΔH	Initial	.144	.144	.144
	Mid	.144	.144	.144
	Final	.144	.144	.144
	Avg.	.144	.144	.144
DRY GAS METER:				
VOL.	Final	844.500	849.500	854.500
(Vd)	Initial	838.000	844.500	849.500
	Vol.	6.500	5.000	5.000
TEMP (°F)	Initial	75	75	75
(Tm)	Mid	75	75	75
	Final	75	75	75
(°F / °A)	Avg.	75 (535)	(535)	(535)

$$Y = \frac{(V_w)(mcf)(BP)(T_m)}{(V_d)\left(BP + \frac{DH}{13.6}\right)(T_w)}$$

$$Y \text{ Factor } \% \text{ Diff.} = \frac{\text{Act} - \text{Exp}}{\text{Exp}} \times 100$$

NOTE : mcf = meter correction (Y) factor for Dry Gas Meter used as a transfer standard

RUN 1

$$Y = \frac{(6.462)(1.002)(29.84)(535)}{(6.500)\left(29.84 + \frac{.144}{13.6}\right)(544)} = \frac{103368.28}{105551.68} = .979$$

$$\Delta \% = \frac{(.973 - .979)}{.979} \times 100 = -.613 \%$$

RUN 2

$$Y = \frac{(4.986)(1.002)(29.84)(535)}{(5.006)\left(29.84 + \frac{.144}{13.6}\right)(544)} = \frac{79757.70}{81193.60} = .982$$

$$\Delta \% = \frac{(.973 - .982)}{.982} \times 100 = -.916 \%$$

JN 3

$$Y = \frac{(4.995)(1.002)(29.84)(535)}{(5.000)\left(29.84 + \frac{.144}{13.6}\right)(545)} = \frac{79901.66}{81347.85} = .982$$

$$\Delta \% = \frac{(.973 - .982)}{.982} \times 100 = -.916 \%$$

NOTE : The Y factor % difference must be $< \pm 5.0 \%$ to be acceptable

INTERPOLATED Y FACTOR

$$\frac{.1}{(A)} \text{ inch H}_2\text{O } \Delta H = \frac{.969}{(C)}$$

Calculated calibration Y factor from calibrations

$$\frac{.2}{(B)} \text{ inch H}_2\text{O } \Delta H = \frac{.977}{(D)}$$

Calculated calibration Y factor from calibrations

$$\frac{.2}{(B)} - \frac{.1}{(A)} = \frac{.1}{(C)} \times 100 = \frac{10}{(E)}$$

$$\frac{.977}{(D)} - \frac{.969}{(C)} = \frac{.008}{(E)} + \frac{10}{(E)} \frac{.0008}{(F)}$$

$$\frac{.144}{\text{Avg } \Delta H} - \frac{.1}{(A)} = \frac{.044}{(C)} \times 100 = \frac{4.4}{(G)}$$

$$\left[\frac{.0008}{(F)} \times \frac{4.4}{(G)} \right] + \frac{.969}{(C)} = \frac{.973}{(G)} \text{ Interpolated Y factor}$$

Volume Metering System Leak Check : 0.000 inch H₂O in one minute

DRY GAS METER CALIBRATION

DATE : 5-15-03 DRY GAS METER : 5 BOX : H

BAROMETRIC PRESSURE <u>30.05</u> in. Hg.				Wet Test Meter Correction Factor Y= <u>1.002</u>			
Orifice Manometer Setting, ΔH , in. H ₂ O		.1	.2	.3	.5	.75	1.0
Gas Volume Wet Test Meter V_w ft ³	Final	<u>524.914</u>	<u>529.865</u>	<u>536.026</u>	<u>541.093</u>	<u>546.058</u>	<u>551.931</u>
	Initial	<u>520.000</u>	<u>524.914</u>	<u>529.865</u>	<u>536.026</u>	<u>541.093</u>	<u>546.058</u>
	V_w ft ³	<u>4.914</u>	<u>4.951</u>	<u>6.161</u>	<u>5.067</u>	<u>4.965</u>	<u>5.873</u>
Gas Volume Dry Test Meter V_d ft ³	Final	<u>380.300</u>	<u>385.300</u>	<u>391.500</u>	<u>396.600</u>	<u>401.600</u>	<u>407.500</u>
	Initial	<u>375.300</u>	<u>380.300</u>	<u>385.300</u>	<u>391.500</u>	<u>396.600</u>	<u>401.600</u>
	V_d ft ³	<u>-5.000</u>	<u>5.000</u>	<u>6.200</u>	<u>5.100</u>	<u>5.000</u>	<u>5.900</u>
Wet Test Meter Temperature t_w	Initial	<u>98</u>	<u>96</u>	<u>94</u>	<u>94</u>	<u>94</u>	<u>94</u>
	Middle	<u>97</u>	<u>95</u>	<u>94</u>	<u>94</u>	<u>94</u>	<u>94</u>
	Final	<u>96</u>	<u>94</u>	<u>94</u>	<u>94</u>	<u>94</u>	<u>94</u>
	Average	<u>97</u> (<u>553</u>)	<u>95</u> (<u>555</u>)	<u>94</u> (<u>554</u>)	<u>94</u> (<u>554</u>)	<u>94</u> (<u>554</u>)	<u>94</u> (<u>554</u>)
Dry Test Meter Temperature t_m	Initial	<u>90</u>	<u>87</u>	<u>87</u>	<u>87</u>	<u>89</u>	<u>91</u>
	Middle	<u>88</u>	<u>87</u>	<u>87</u>	<u>88</u>	<u>90</u>	<u>90</u>
	Final	<u>87</u>	<u>87</u>	<u>87</u>	<u>89</u>	<u>91</u>	<u>90</u>
	Average	<u>88</u> (<u>548</u>)	<u>87</u> (<u>547</u>)	<u>87</u> (<u>547</u>)	<u>88</u> (<u>548</u>)	<u>90</u> (<u>550</u>)	<u>90</u> (<u>550</u>)
$Y = \frac{(W_{mcf})(V_w)(P_b)(t_m)}{V_d \left(P_b + \frac{\Delta H}{13.6} \right) (t_w)}$		<u>.969</u>	<u>.977</u>	<u>.982</u>	<u>.984</u>	<u>.986</u>	<u>.988</u>

Average Y= .981

METER BOX CALIBRATION

Avg = 1.002

Date : 08/09/02
 Calibrated By : J.C.
 Dry Gas Meterbox ID : K2

Barometric Pressure, Pb = 27.55 in. Hg
 Vacuum = 0.0 in. Hg

Orifice Manometer
 Setting, Delta H
 in. H2O

0.10	0.10	0.10	0.10	0.10	0.10
------	------	------	------	------	------

Gas Volume Wet Test Meter
 Vw, cu. ft.

10.052	10.959	10.626	10.369	10.759	10.717
--------	--------	--------	--------	--------	--------

Gas Volume Dry Gas Meter

M Final	69.409	81.103	92.442	103.393	114.942	126.250
M Initial	59.175	69.802	81.457	92.680	103.826	115.224
Vd, cu. ft.	10.234	11.301	10.985	10.713	11.116	11.026

Wet Test Meter
 tw Deg F
 tw Deg A

68	67	69	70	72	74
528	527	529	530	532	534

Dry Gas Meter
 Outlet, tmo

1)	72	75	77	78	80	82
2)	73	76	78	79	82	82
3)	74	78	79	80	83	82

Dry Gas Meter
 Inlet tmi

1)	79	88	95	98	99	100
2)	85	92	99	100	101	101
3)	89	98	102	101	102	102

Mean tm, Deg F
 Mean tm, Deg A

79	85	88	89	91	92
539	545	548	549	551	552

Results :

Y =	1.002	1.002	1.002	1.003	1.003	1.004
-----	-------	-------	-------	-------	-------	-------

Averages :

Y = 1.003

METER BOX CALIBRATION

Date : 08/09/02
 Calibrated By : J.C.
 Dry Gas Meterbox ID : K2

Barometric Pressure, Pb = 27.55 in. Hg
 Vacuum = 0.0 in. Hg

Orifice Manometer
 Setting, Delta H
 in. H2O

0.20 0.20 0.20 0.20 0.20 0.20

Gas Volume Wet Test Meter
 Vw, cu. ft.

10.000 10.000 10.000 10.400 10.000 10.000

Gas Volume Dry Gas Meter

	125.454	135.756	146.114	156.919	167.309	177.665
M Final	125.454	135.756	146.114	156.919	167.309	177.665
M Initial	115.224	125.454	135.756	146.114	156.919	167.309
Vd, cu. ft.	10.230	10.302	10.358	10.805	10.390	10.356

Wet Test Meter
 tw Deg F
 tw Deg A

	67	68	70	71	72	73
tw Deg F	527	528	530	531	532	533

Dry Gas Meter
 Outlet, tmo

	74	76	78	81	84	85
1)	74	76	78	81	84	85
2)	74	78	80	82	85	86
3)	76	78	81	84	85	86

Dry Gas Meter
 Inlet tmi

	83	87	95	102	103	103
1)	83	87	95	102	103	103
2)	85	92	99	104	104	105
3)	87	96	104	105	105	105

Mean tm, Deg F
 Mean tm, Deg A

	80	85	90	93	94	95
Mean tm, Deg F	540	545	550	553	554	555

Results :

	1.001	1.000	1.000	1.002	1.002	1.005
Y =	1.001	1.000	1.000	1.002	1.002	1.005

Averages :

Y = 1.002

METER BOX CALIBRATION

Date : 08/09/02
 Calibrated By : J.C.
 Dry Gas Meterbox ID : K2

Barometric Pressure, Pb = 27.55 in. Hg
 Vacuum = 0.0 in. Hg

Orifice Manometer
 Setting, Delta H
 in. H2O

0.30	0.30	0.30	0.30	0.30	0.30
------	------	------	------	------	------

Gas Volume Wet Test Meter
 Vw, cu. ft.

10.000	10.900	10.600	10.000	10.000	10.800
--------	--------	--------	--------	--------	--------

Gas Volume Dry Gas Meter

M Final	187.917	199.173	210.167	220.584	230.982	242.208
M Initial	177.665	187.917	199.173	210.167	220.584	230.982
Vd, cu. ft.	10.252	11.256	10.994	10.417	10.398	11.226

Wet Test Meter
 tw Deg F
 tw Deg A

67	67	68	69	70	69
527	527	528	529	530	529

Dry Gas Meter
 Outlet, tmo

1)	71	73	75	76	77	77
2)	73	74	75	76	77	77
3)	74	75	76	77	77	77

Dry Gas Meter
 Inlet tmi

1)	85	90	94	100	105	105
2)	88	94	98	104	106	106
3)	93	98	102	105	106	106

Mean tm, Deg F
 Mean tm, Deg A

81	84	87	90	91	91
541	544	547	550	551	551

Results :

Y =	1.001	0.999	0.998	0.997	1.000	1.002
-----	-------	-------	-------	-------	-------	-------

Averages :

Y =	1.000
-----	-------

METER BOX CALIBRATION

Date : 08/09/02
 Calibrated By : J.C.
 Dry Gas Meterbox ID : K2

Barometric Pressure, Pb = 27.55 in. Hg
 Vacuum = 0.0 in. Hg

Orifice Manometer
 Setting, Delta H
 in. H2O

0.50	0.50	0.50	0.50	0.50	0.50
------	------	------	------	------	------

Gas Volume Wet Test Meter
 Vw, cu. ft.

10.000	10.000	10.000	10.000	10.200	10.000
--------	--------	--------	--------	--------	--------

Gas Volume Dry Gas Meter

M Final	252.471	262.818	273.200	283.635	294.271	304.672
M Initial	242.208	252.471	262.818	273.200	283.635	294.271
Vd, cu. ft.	10.263	10.347	10.382	10.435	10.636	10.401

Wet Test Meter

tw Deg F
 tw Deg A

70	70	71	71	71	72
530	530	531	531	531	532

Dry Gas Meter

Outlet, tmo

1)	73	78	82	84	86	87
2)	75	80	83	86	87	88
3)	78	83	85	87	87	88

Dry Gas Meter

Inlet tmi

1)	87	93	96	101	103	102
2)	93	103	105	107	109	106
3)	96	105	110	110	110	110

Mean tm, Deg F

Mean tm, Deg A

84	90	94	96	97	97
544	550	554	556	557	557

Results :

Y =	0.999	1.002	1.003	1.002	1.005	1.005
-----	-------	-------	-------	-------	-------	-------

Averages :

Y =	1.003
-----	-------

METER BOX CALIBRATION

Date : 08/09/02
 Calibrated By : J.C.
 Dry Gas Meterbox ID : K2

Barometric Pressure, Pb = 27.55 in. Hg
 Vacuum = 0.0 in. Hg

Orifice Manometer
 Setting, Delta H
 in. H2O

0.75 0.75 0.75 0.75 0.75 0.75

Gas Volume Wet Test Meter
 Vw, cu. ft.

10.000 10.000 10.000 10.000 10.000 10.000

Gas Volume Dry Gas Meter

	314.761	324.890	335.031	345.191	355.387	365.617
M Final	314.761	324.890	335.031	345.191	355.387	365.617
M Initial	304.672	314.761	324.890	335.031	345.191	355.387
Vd, cu. ft.	10.089	10.129	10.141	10.160	10.196	10.230

Wet Test Meter
 tw Deg F
 tw Deg A

	69	69	70	71	71	71
tw Deg F	69	69	70	71	71	71
tw Deg A	529	529	530	531	531	531

Dry Gas Meter
 Outlet, tmo

	72	74	75	77	78	79
1)	72	74	75	77	78	79
2)	74	75	76	77	78	79
3)	75	75	77	78	79	80

Dry Gas Meter
 Inlet tmi

	74	78	81	84	86	88
1)	74	78	81	84	86	88
2)	76	80	82	85	88	91
3)	77	81	83	87	89	93

Mean tm, Deg F
 Mean tm, Deg A

	75	77	79	81	83	85
Mean tm, Deg F	75	77	79	81	83	85
Mean tm, Deg A	535	537	539	541	543	545

Results :

	1.000	1.001	1.001	1.001	1.001	1.001
Y =	1.000	1.001	1.001	1.001	1.001	1.001

Averages :

Y = 1.001

METER BOX CALIBRATION

Date : 08/09/02
 Calibrated By : J.C.
 Dry Gas Meterbox ID : K2

Barometric Pressure, Pb = 27.55 in. Hg
 Vacuum = 0.0 in. Hg

Orifice Manometer

Setting, Delta H
 in. H2O

1.00	1.00	1.00	1.00	1.00	1.00
------	------	------	------	------	------

Gas Volume Wet Test Meter

Vw, cu. ft.

10.000	10.000	10.000	10.400	10.000	10.000
--------	--------	--------	--------	--------	--------

Gas Volume Dry Gas Meter

M Final

375.804	386.030	396.294	406.992	417.296	427.619
---------	---------	---------	---------	---------	---------

M Initial

365.617	375.804	386.030	396.294	406.992	417.296
---------	---------	---------	---------	---------	---------

Vd, cu. ft.

10.187	10.226	10.264	10.698	10.304	10.323
--------	--------	--------	--------	--------	--------

Wet Test Meter

tw Deg F
 tw Deg A

72	72	73	73	73	74
532	532	533	533	533	534

Dry Gas Meter

Outlet, tmo

1)	77	78	80	82	82	83
2)	78	80	81	82	83	83
3)	78	81	82	83	83	83

Dry Gas Meter

Inlet tmi

1)	85	90	95	96	98	101
2)	88	92	96	98	100	103
3)	91	93	98	99	102	104

Mean tm, Deg F

Mean tm, Deg A

83	86	89	90	91	93
543	546	549	550	551	553

Results :

Y = 0.999 1.000 1.000 1.000 1.001 1.000

Averages :

Y = 1.000

WET TEST METER CALIBRATION LOG

Wet Test Meter Serial Number AA 455 Date 8-07-02

Range of Wet Test Meter Flow Rate 0 - 0.25

Volume of Test Flask Vs 37.850

Satisfactory Leak Check? ✓

Ambient Temperature of Equilibrate Liquid in Wet Test Meter and Reservoir 79°F

TEST #	MANOMETER READING, a mm H ₂ O	FINAL VOLUME (Vf), l	INITIAL VOLUME (Vi), l	TOTAL VOLUME (Vm), bl	FLASK VOLUME (Vs), l	PERCENT ERROR, c %
1	∅	3.0	rest to ∅	3.0	3.004	- .133
2	∅	3.0	rest to ∅	3.0	3.005	- .166
3	∅	3.0	rest to ∅	3.0	3.007	- .233

a - Must be less than 10 mm H₂O (0.4 'H₂O)

Calculations:

b - $V_m - V_f - V_i$

c - % error = $\frac{100 (V_m - V_s)}{V_s} = \underline{- .177} \quad (\pm 1 \%)$

SO₂ ROTAMETER CALIBRATION

Last Cal. : 11-11-02 By : Op W. Date : 5-15-2003 By : CPW

Manufacturer : SKC-WEST
SKC ACCUFLOW Digital Flow Calibrator: Model 712

SN : 311325

Barometric Pressure : 30.18 " Hg Temperature : 74.2

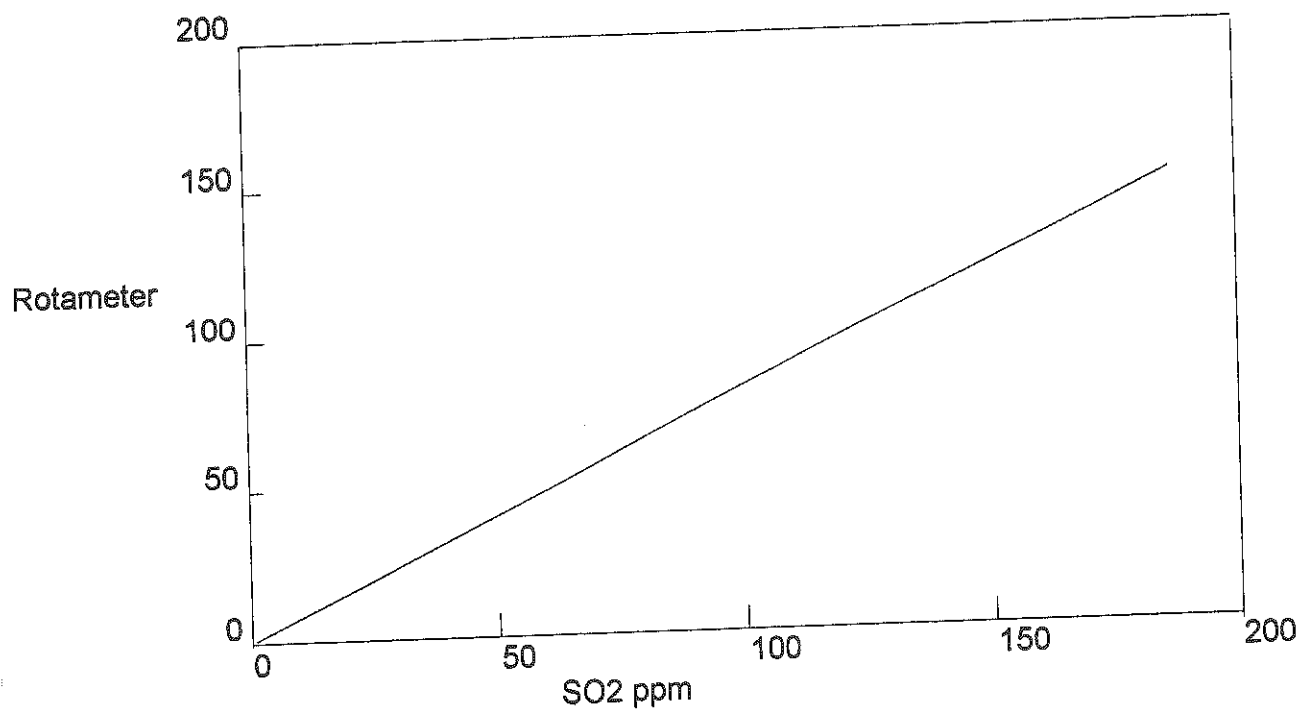
RUN #	50 CC/MINUTE	100 CC/MINUTE	150 CC/MINUTE
	DIGITAL VOLUME	DIGITAL VOLUME	DIGITAL VOLUME
1	55.4	118.8	173.0
2	55.1	118.9	173.2
3	55.3	118.8	173.1
4	55.3	119.0	173.0
5	55.2	118.9	173.3
6	55.4	118.7	173.4
7	55.2	118.9	173.0
8	55.2	118.7	173.2
9	55.2	118.8	173.2
10	55.3	118.9	173.1
AVERAGE	55.26 cc/min	118.81 cc/min	173.15 cc/min

SETTING	cc/min
0	0
50	55.3
100	118.8
150	173.2

Rotometer setting for 100 cc/minute based on regression with this data.

100 CC / MINUTE = 86.3

SO2 Rotameter
05/15/03



Regression Output:

Constant	-0.64
Std Err of Y Est	2.7538155349
R Squared	0.9991086335
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	1.1662
Std Err of Coef.	0.0246308749

TRACER GAS TRAIN RESPONSE TIME

DATE: 5-15-2003

Elapsed Time	SO ₂ Conc. (v.)	SO ₂ Conc. (v.)	SO ₂ Conc. (v.)
00 sec	.500	.501	.500
15	.317	.309	.310
30	.200	.195	.198
45	.157	.150	.152
60	.073	.070	.069
75	.049	.050	.050
90	.038	.037	.037
105	.027	.025	.024
120	.020	.018	.017
135	.013	.011	.010
150	.008	.005	.005
165	.004	.002	.002
180	.001	.001	.001
Initial Response	11	10	10
95 % Response	104	104	104
Flow Rate	1.5	1.5	1.5

CEM GAS TRAIN RESPONSE TIME

[illegible]

ORSAT ANALYSIS DATA SHEET

DATE: 5-15-03

Gas	1	2	3	AVE	CONC	TANK ID
CO ₂	0	0	0	0	N ₂	042TAC-2-A
O ₂	0	0	0	0	N ₂	
CO	0	0	0	0	N ₂	
CO ₂	6.2	6.2	6.2	6.2	6.22	CC-12731
O ₂	6.3	6.2	6.2	6.23	6.25	
CO	2.0	2.0	2.0	2.0	1.98	
CO ₂	12.4	12.4	12.4	12.4	12.4	CC-3131
O ₂	12.5	12.5	12.5	12.5	12.5	
CO	5.0	5.0	5.0	5.0	5.0	
CO ₂	21.2	21.2	21.3	21.23	21.23	CC55904
O ₂	21.1	21.1	21.1	21.0	21.10	
CO	8.6	8.6	8.6	8.6	8.6	
CO ₂						
O ₂						
CO						

CO₂ ANALYZER MULTIPOINT CALIBRATION REPORT FORM

Date: 10/13/03
 Analyzer: Make: HORIBA Model: PIR 2000 SN: 407069
 Calibration by: D. Washington
 Cal Gas Flow: 1.5 SCFH Measured by: Rotameter
 BP: 30.34 Instrument ID: PRINCO
 Temp: 75 Instrument ID: TR

Cylinders:

1. # 042TAC 2-A Concentration: 00.00 % CO₂ Cyl. Press.: 480 PSI
 Certified by: AIR LIQUIDE Date: 02-20-02
2. # CC-3131 Concentration: 12.40 % CO₂ Cyl. Press.: 1025 PSI
 Certified by: AIR LIQUIDE Date: 03-13-03
3. # CC55904 Concentration: 21.23 % CO₂ Cyl. Press.: 620 PSI
 Certified by: AIR LIQUIDE Date: 02-14-00
4. # CC-12731 Concentration: 6.22 % CO₂ Cyl. Press.: 1620 PSI
 Certified by: AIR LIQUIDE Date: 03-13-03

Analyzer: Calibrated Range: 0-25.0 %
 Flow: 1.5 SCFH

Output: 0-1.0 V.
 Measured by: Rotameter

Calibration Results

Point #	CYL #	% CO ₂	EXPECTED		ACTUAL		ADJ.	
			METER	DVM	METER	DVM	METER	DVM
1	1	0.00	00.0	.000	00.1	.001	00.0	.000
2	2	12.40	49.6	.496	50.0	.500	49.6	.496
3	3	21.23	84.9	.849	85.1	.851		
4	4	6.22	24.9	.249	25.1	.251		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 12.472

CO₂ Linear Regression Results:

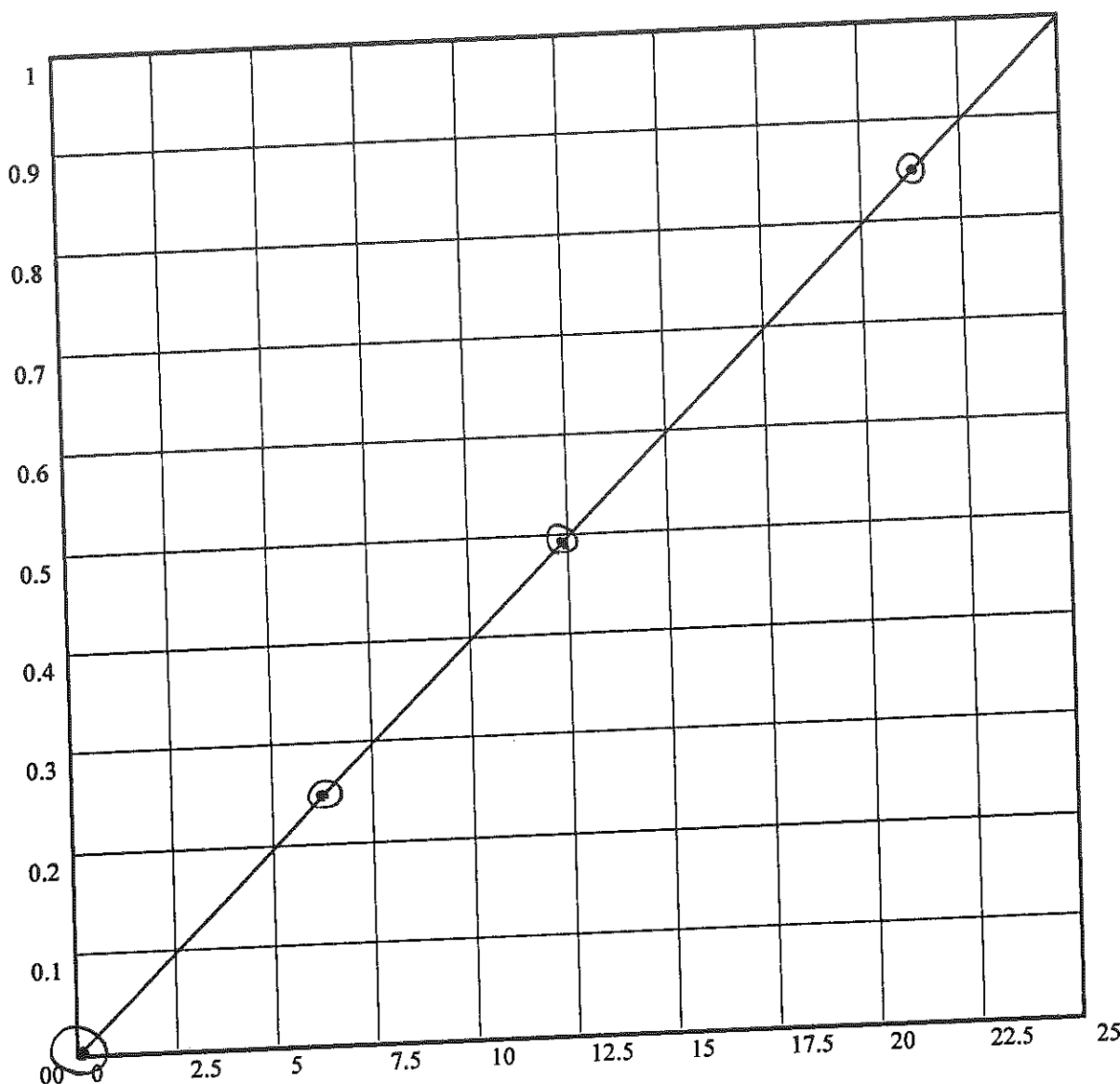
$$Y = MX + B$$

$$\text{Slope (M)} = \underline{.0005124}$$

$$\text{Y Intercept (B)} = \underline{.0400489}$$

$$\text{Correlation Coefficient (r)} = \underline{.9999956}$$

$$r^2 = \underline{.9999912}$$

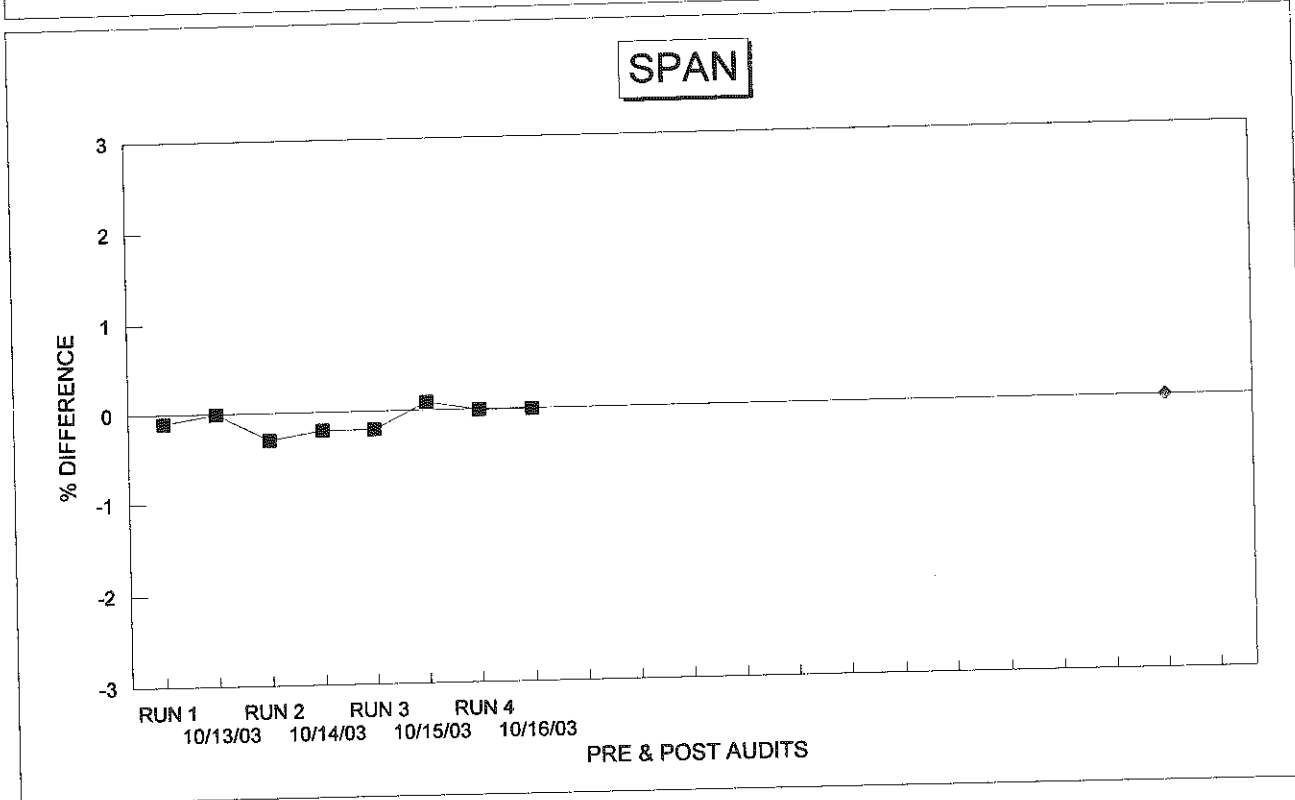
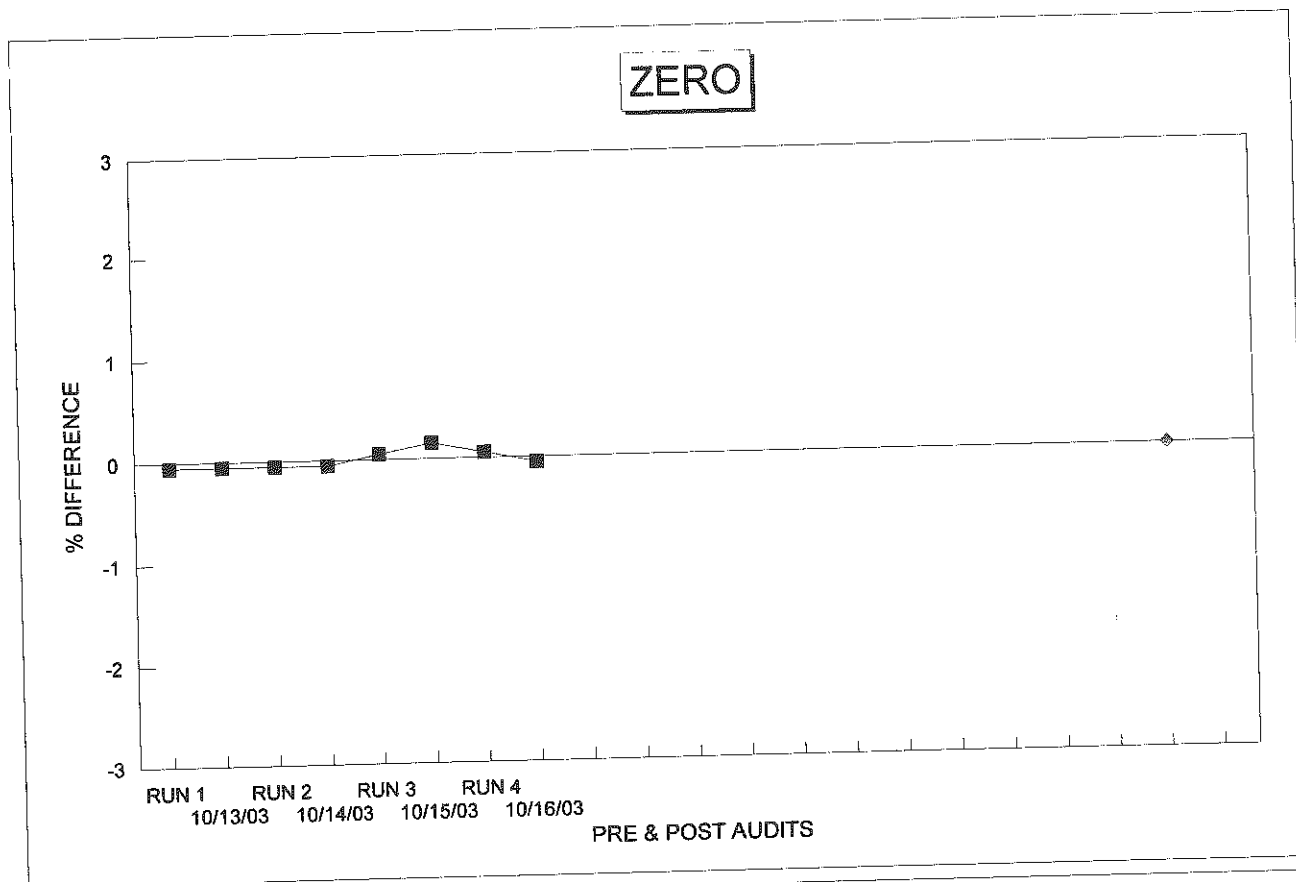


EPA Span Value = $\pm 2.0\%$ of $25\% \text{ CO}_2 = \pm .5\%$

Cal Volts = Cal Volt Conc - Std Conc = $\pm$ Conc Diff = $\pm \Delta\%$

$$\text{HIGH VOLTS} \quad \underline{.851} = \underline{21.275} - \underline{21.23} = \underline{.045} = \underline{.180}$$

$$\text{LOW VOLTS} \quad \underline{.251} = \underline{6.275} - \underline{6.22} = \underline{.055} = \underline{.220}$$



O₂ ANALYZER MULTIPOINT CALIBRATION REPORT FORM

Date: 10/13/03
 Analyzer: Make: TELEDYNE Model: 320A SN: 37400
 Calibration by: D. Washington
 Cal Gas Flow: 1.5 SCFH Measured by: Rotameter
 BP: 30.34 Instrument ID: PRINCO
 Temp: 75 Instrument ID: TR

Cylinders:

1. # 042TAC 2-A Concentration: 00.00 % O₂ Cyl. Press.: 480 PSI
 Certified by: AIR LIQUIDE Date: 02-20-02
2. # CC-3131 Concentration: 12.50 % O₂ Cyl. Press.: 1025 PSI
 Certified by: AIR LIQUIDE Date: 03-13-03
3. # CC55904 Concentration: 21.10 % O₂ Cyl. Press.: 620 PSI
 Certified by: AIR LIQUIDE Date: 02-14-00
4. # CC-12731 Concentration: 6.25 % O₂ Cyl. Press.: 1620 PSI
 Certified by: AIR LIQUIDE Date: 03-13-03

Analyzer: Calibrated Range: 0-25.0 %
 Flow: 1.5 SCFH

Output: 0-1.0 V.
 Measured by: Rotameter

Calibration Results

Point #	CYL. #	% O ₂	EXPECTED		ACTUAL		ADJ.	
			METER	DVM	METER	DVM	METER	DVM
1	1	0.00	00.0	.000	00.0	.001	00.0	.000
2	2	12.50	12.50	.500	12.55	.502	12.50	.500
3	3	21.10	21.10	.844	21.10	.846		
4	4	6.25	6.25	.250	6.25	.251		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 12.476

O₂ Linear Regression Results:

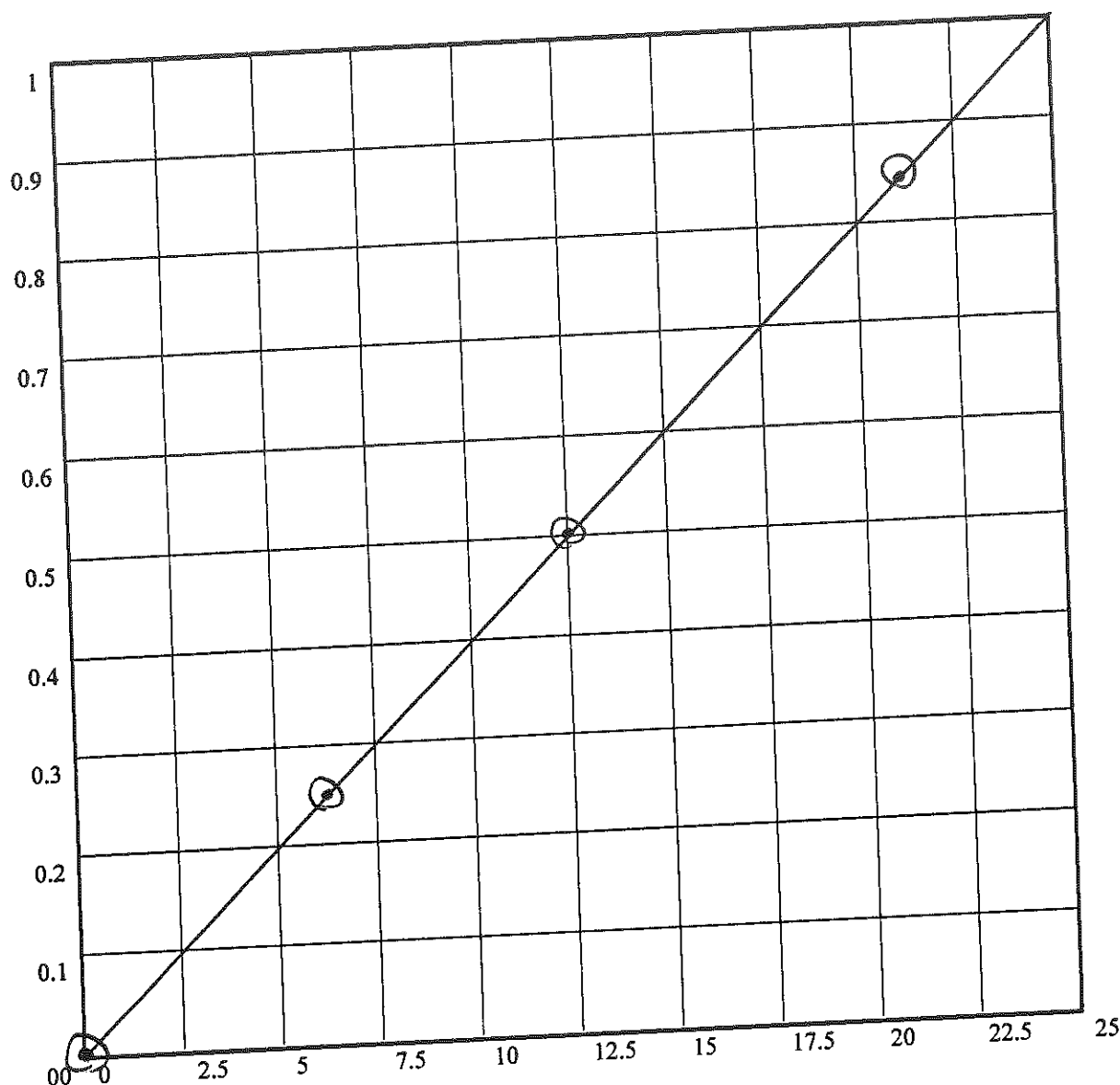
$$Y = MX + B$$

$$\text{Slope (M)} = \underline{-,0000094}$$

$$\text{Y Intercept (B)} = \underline{,0400762}$$

$$\text{Correlation Coefficient (r)} = \underline{,9999983}$$

$$r^2 = \underline{,9999966}$$



EPA Span Value = $\pm 2.0\%$ of $25\% \text{ O}_2 = \pm .5\%$

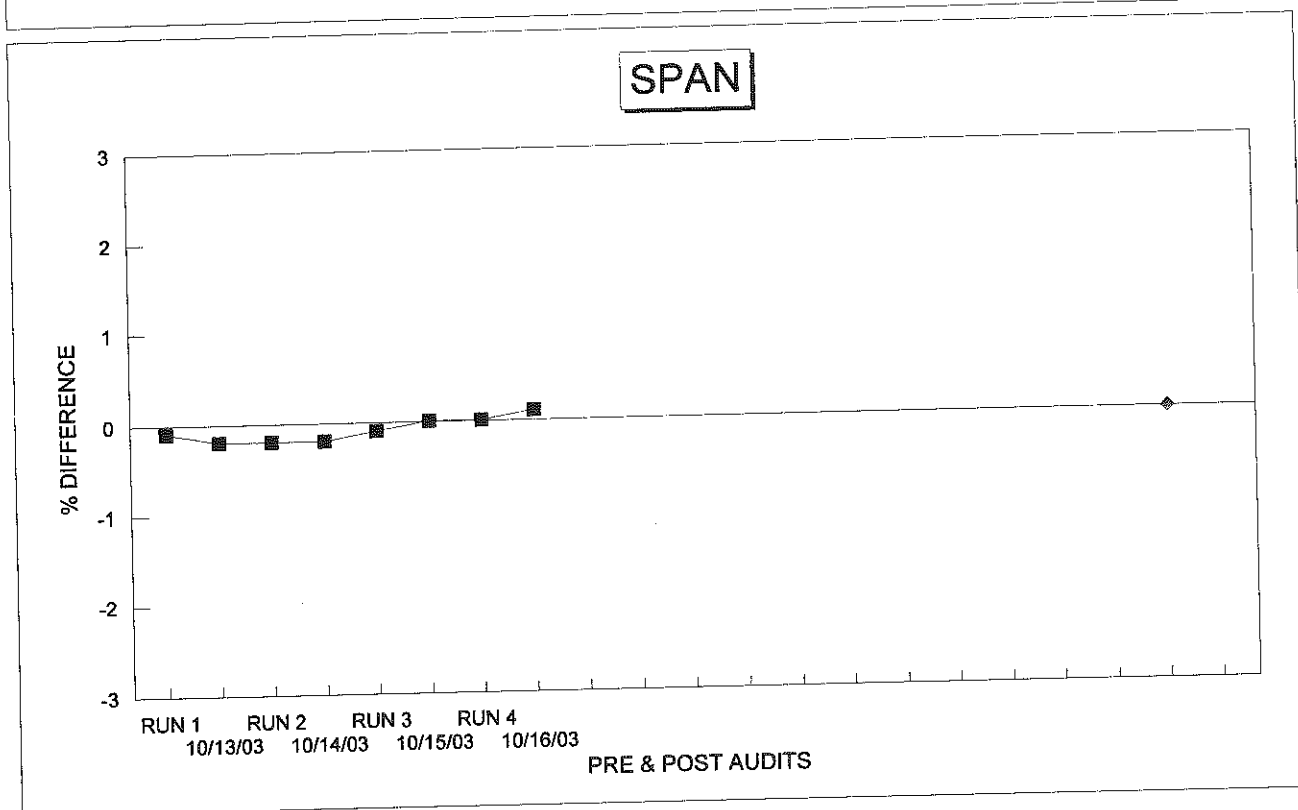
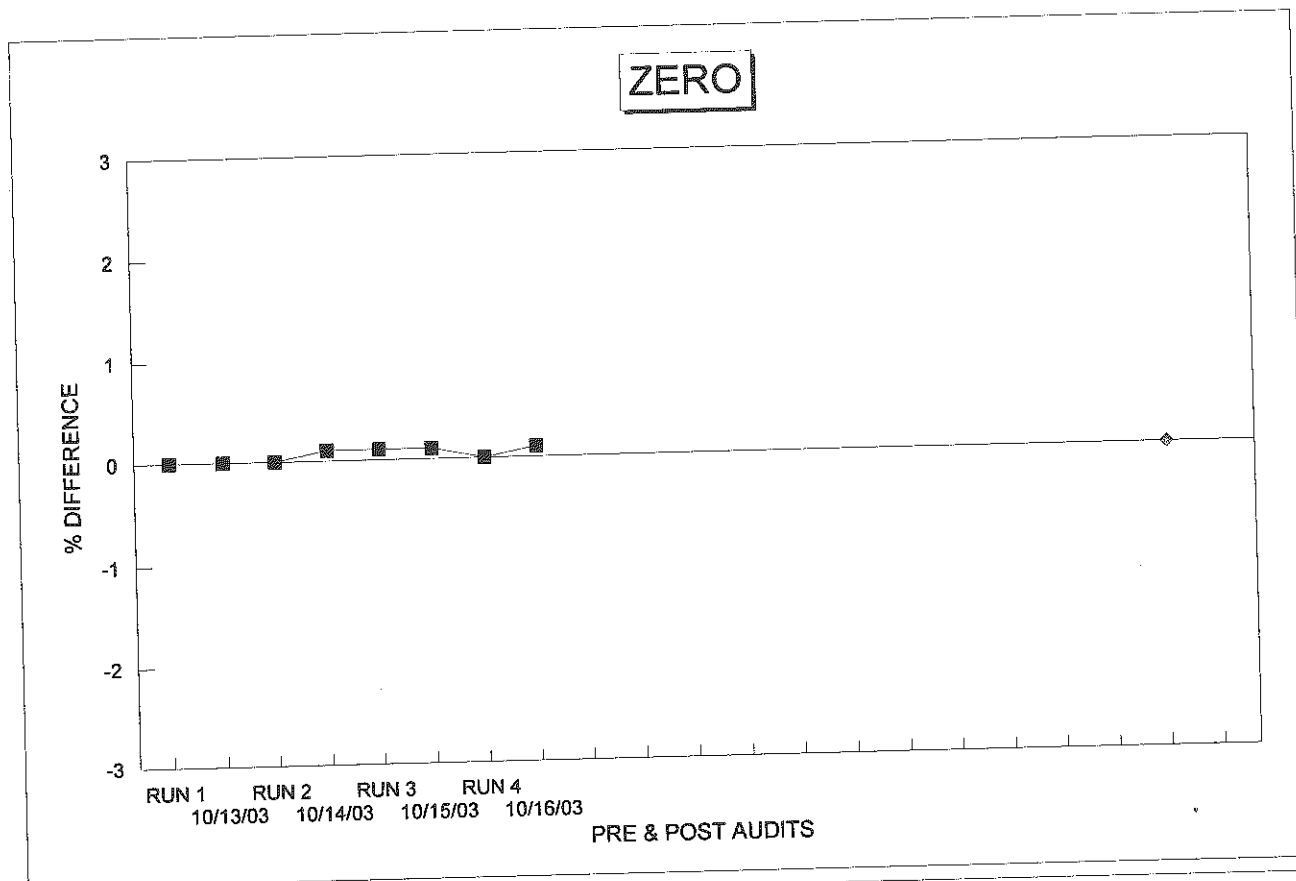
Cal Volts = Cal Volt Conc - Std Conc = $\pm \text{Conc Diff} = \pm \Delta\%$

HIGH
VOLTS

$$\underline{,846} = \underline{21.150} - \underline{21.10} = \underline{,050} = \underline{,200}$$

LOW
VOLTS

$$\underline{,251} = \underline{6.275} - \underline{6.25} = \underline{,025} = \underline{,100}$$



CO ANALYZER MULTIPOINT CALIBRATION REPORT FORM

Date: 10/13/03
 Analyzer: Make: HORIBA Model: PIR 2000 SN: 408005
 Calibration by: D. Wadsworth Measured by: Rotameter
 Cal Gas Flow: 1.5 SCFH Instrument ID: PRINCO
 BP: 30.34 Instrument ID: TR
 Temp: 75

Cylinders:

1. # 042TAC 2-A Concentration: 00.00 % CO Cyl. Press.: 480 PSI
 Certified by: AIR LIQUIDE Date: 02-20-02
2. # CC-3131 Concentration: 5.02 % CO Cyl. Press.: 1025 PSI
 Certified by: AIR LIQUIDE Date: 03-13-03
3. # CC55904 Concentration: 8.60 % CO Cyl. Press.: 620 PSI
 Certified by: AIR LIQUIDE Date: 02-14-00
4. # CC-12731 Concentration: 1.98 % CO Cyl. Press.: 1620 PSI
 Certified by: AIR LIQUIDE Date: 03-13-03

Analyzer: Calibrated Range: 0-10.0 %
 Flow: 1.5 SCFH

Output: 0-1.0 V.
 Measured by: Rotameter

Calibration Results

Point #	CYL. #	% CO	EXPECTED		ACTUAL		ADJ.	
			METER	DVM	METER	DVM	METER	DVM
1	1	0.00	00.0	.000	.000	.000	00.0	.000
2	2	5.02	50.2	.502	50.6	.506	50.2	.502
3	3	8.60	86.0	.860	85.6	.856		
4	4	1.98	19.8	.198	19.6	.196		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 5.019

CO Linear Regression Results:

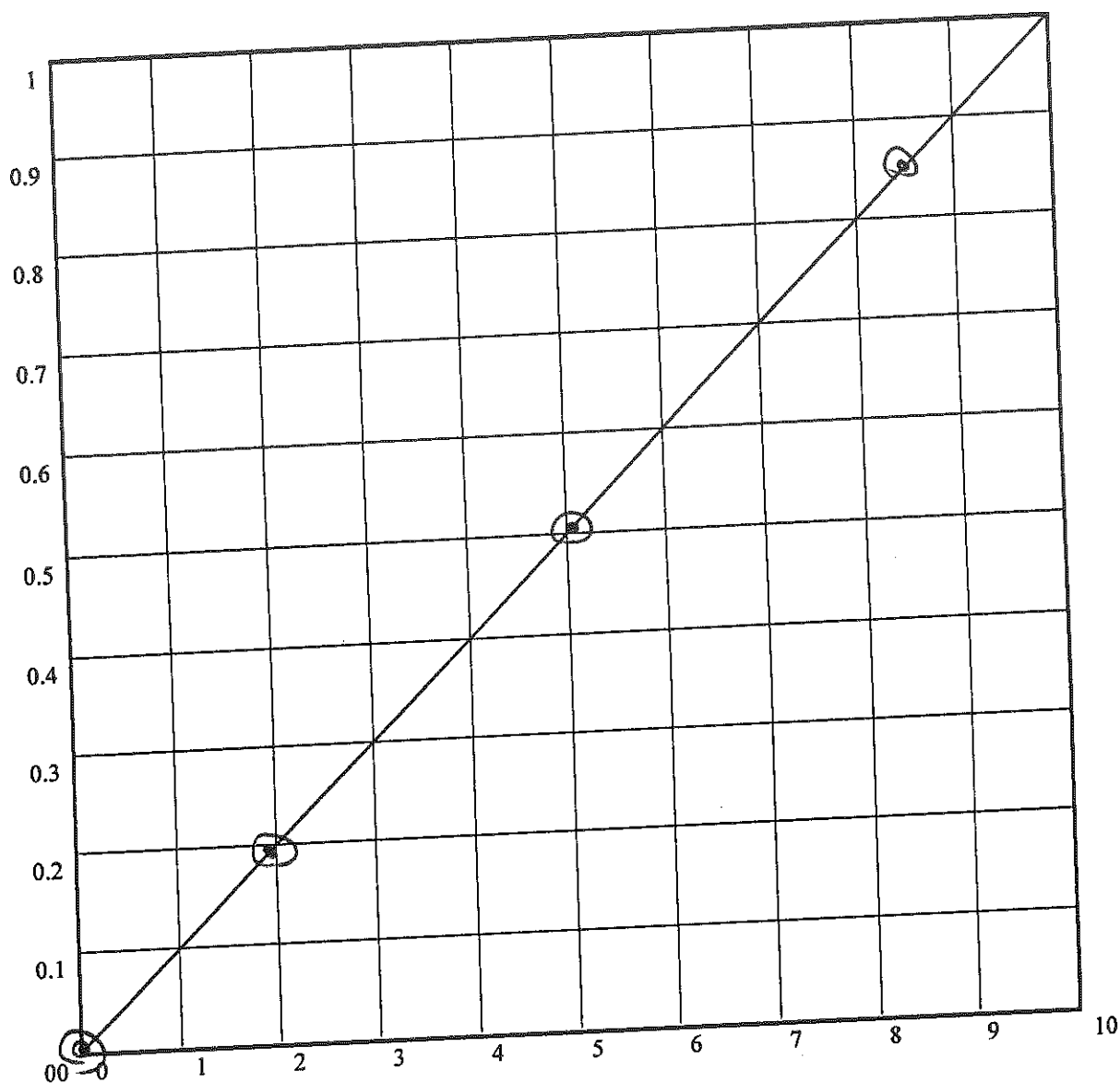
$$Y = MX + B$$

$$\text{Slope (M)} = \underline{-0.0001188}$$

$$\text{Y Intercept (B)} = \underline{0.0996458}$$

$$\text{Correlation Coefficient (r)} = \underline{0.9999932}$$

$$r^2 = \underline{0.9999864}$$

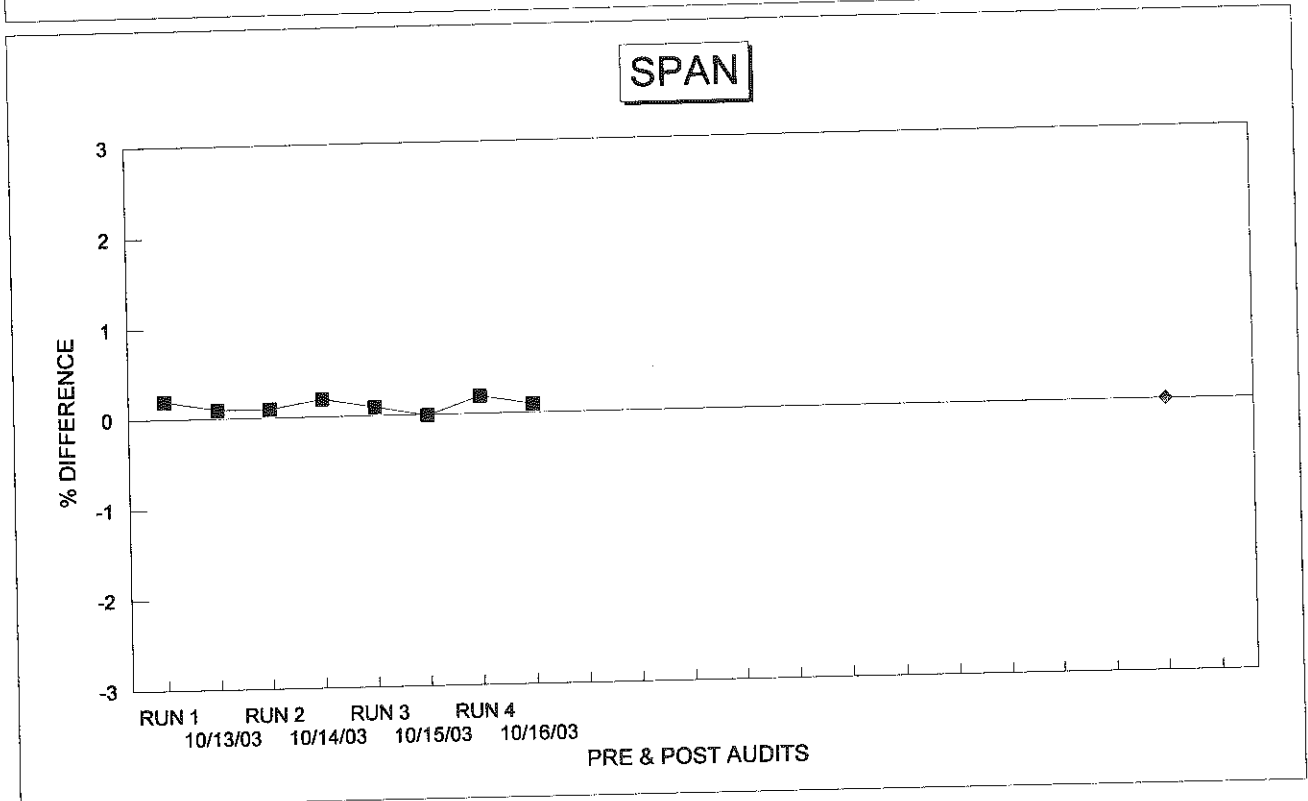
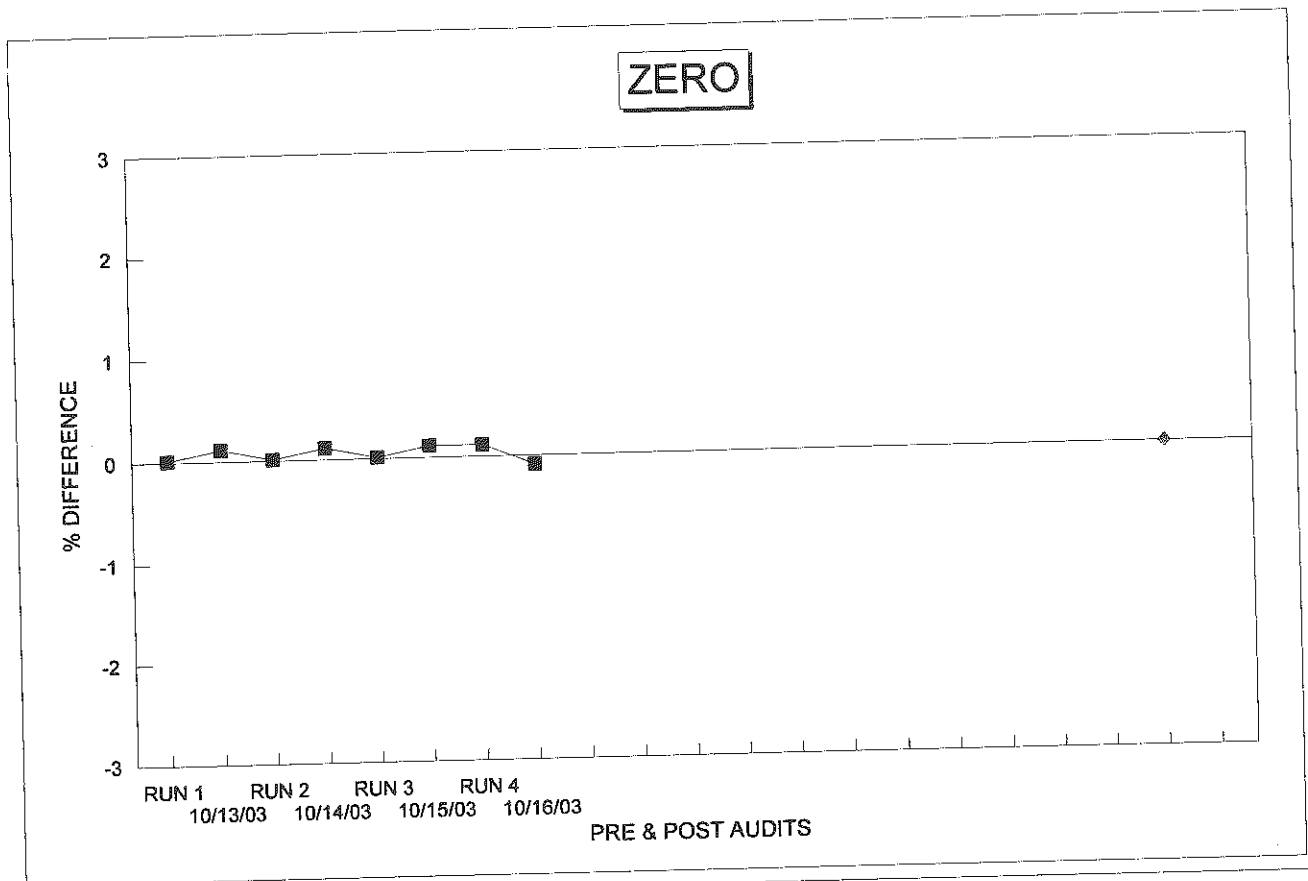


EPA Span Value = $\pm 2.0\%$ of $10\% \text{ CO} = \pm .2\%$

Cal Volts = Cal Volt Conc - Std Conc = $\pm \text{Conc Diff} = \pm \Delta \%$

$$\text{HIGH VOLTS} \quad \underline{.856} = \underline{8.56} - \underline{8.60} = \underline{-.040} = \underline{-.400}$$

$$\text{LOW VOLTS} \quad \underline{.196} = \underline{1.96} - \underline{1.98} = \underline{-.020} = \underline{-.200}$$



SO₂ ANALYZER MULTIPOINT CALIBRATION REPORT FORM

Date: 10/13/03
 Analyzer: Make: HORIBA Model: PIR 2000 SN: 403019
 Calibration by: D. Wadsworth
 Cal Gas Flow: 1.5 SCFH Measured by: Rotameter
 BP: 30.34 Instrument ID: PRINCO
 Temp: 75 Instrument ID: TR

Cylinders:

1. # 042TAC 2-A Concentration: 00 00 % SO₂ Cyl. Press.: 480 PSI
 Certified by: AIR LIQUIDE Date: 02-20-02
2. # CC62184 Concentration: 1290 % SO₂ Cyl. Press.: 850 PSI
 Certified by: AIR LIQUIDE Date: 01-29-01
3. # ALMO 49127 Concentration: 1770 % SO₂ Cyl. Press.: 850 PSI
 Certified by: SCOTT SPECIALTY GASES Date: 05-15-97
4. # ALMO 52285 Concentration: 506 % SO₂ Cyl. Press.: 790 PSI
 Certified by: SCOTT SPECIALTY GASES Date: 05-15-97

Analyzer: Calibrated Range: 0-2500 PPM
 Flow: 1.5 SCFH

Output: 0-1.0 V.
 Measured by: Rotameter

Calibration Results

Point #	CYL. #	PPM SO ₂	EXPECTED		ACTUAL		ADJ.	
			METER	DVM	METER	DVM	METER	DVM
1	1	0.00	00.0	.000	00.3	.003	00.0	.000
2	2	1290	51.6	.516	52.0	.520	51.6	.516
3	3	1770	70.8	.708	71.2	.712		
4	4	506	20.2	.202	20.2	.202		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 1246.008

SO₂ Linear Regression Results:

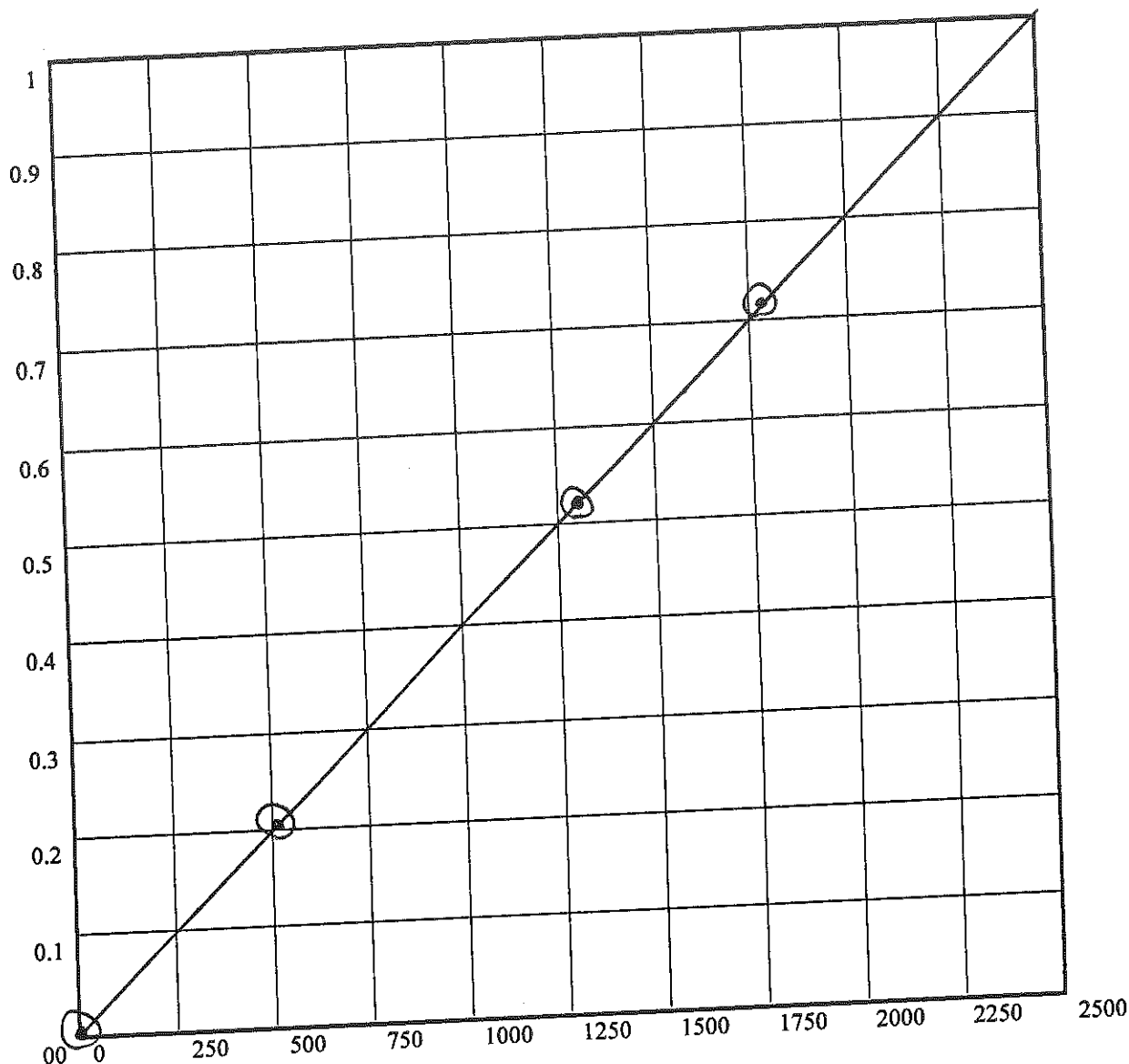
$$Y = MX + B$$

$$\text{Slope (M)} = \underline{-0.0008451}$$

$$\text{Y Intercept (B)} = \underline{0.0004020}$$

$$\text{Correlation Coefficient (r)} = \underline{0.9999905}$$

$$r^2 = \underline{0.9999810}$$



EPA Span Value = $\pm 2.0\%$ of 2500 PPM SO₂ = ± 50 PPM

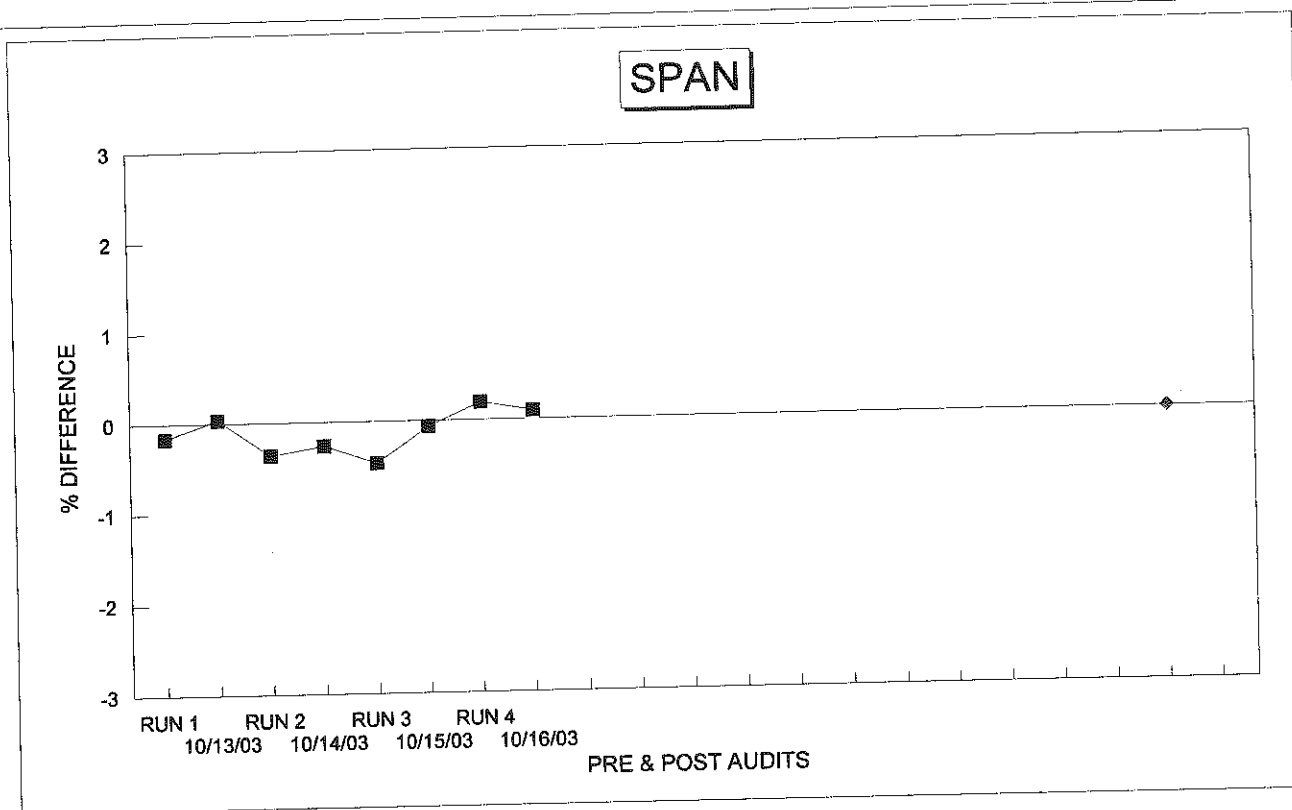
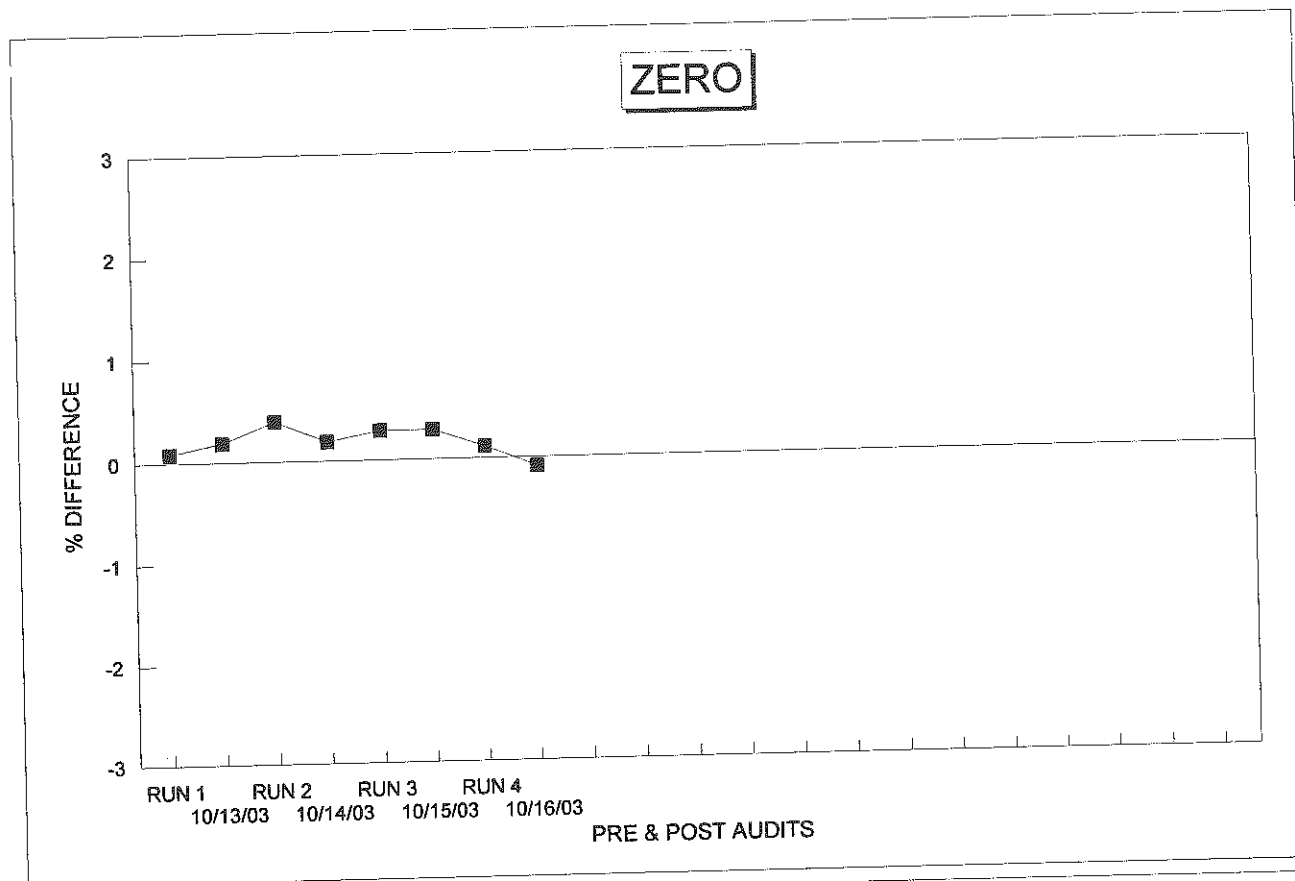
Cal Volts = Cal Volt Conc - Std Conc = $\pm$ Conc Diff = $\pm \Delta\%$

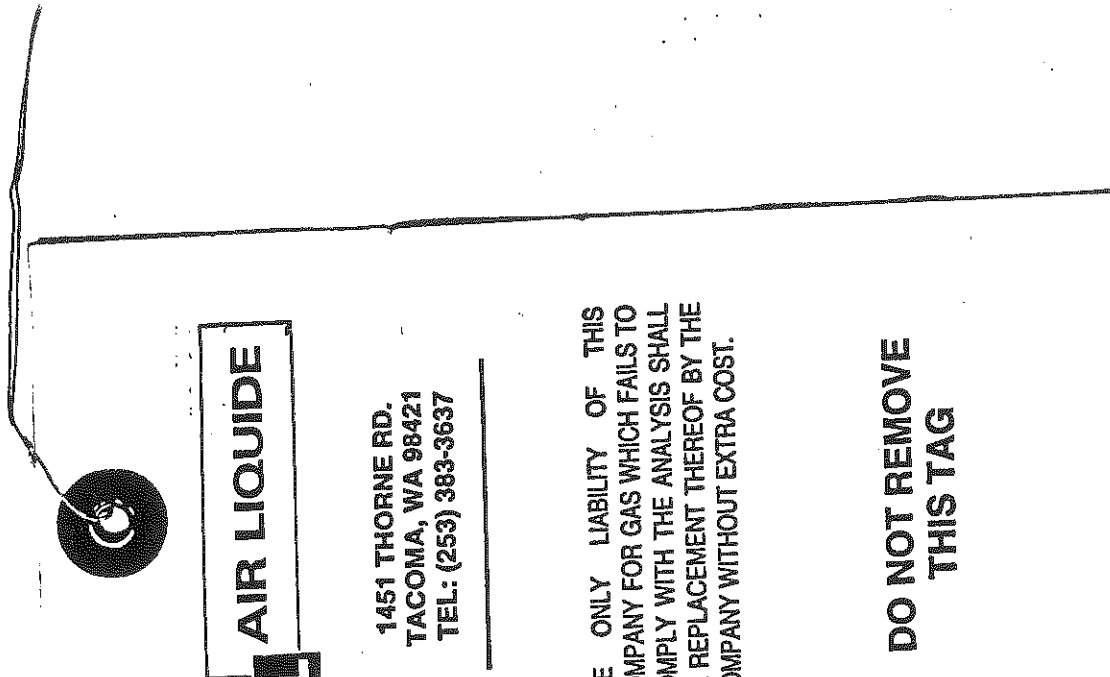
HIGH
VOLTS

$$\underline{0.712} = \underline{1779.6} - \underline{1770.0} = \underline{9.60} = \underline{0.384}$$

LOW
VOLTS

$$\underline{0.202} = \underline{505.6} - \underline{506.0} = \underline{-0.40} = \underline{-0.016}$$





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**

GASES FOR RESEARCH AND DEVELOPMENT

TEST # 07263 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

GASES FOR RESEARCH AND DEVELOPMENT

CYL # CC55904 CGA 590

PRES 1650 VOL 150 LF

TEST # 04500 DATE 02-14-00

Analytical Method GC / Paramagnetic

	Requested	Analyzed
Hydrogen		
Nitrogen	<u>Bal.</u>	<u>Bal.</u>
Argon		
Air		
Carbon Monoxide	<u>8.5%</u>	<u>8.60%</u>
Methane		
Oxygen	<u>21%</u>	<u>21.10%</u>
Helium		
Carbon Dioxide	<u>21%</u>	<u>21.23%</u>


SIGNED



AIR LONDE

GASES FOR RESEARCH AND DEVELOPMENT

CC-3131 CGA 590

PRES 1665 VOL 130cf.

TEST # 07203 DATE 03-13-03

Analytical Method GC/Paramagnetic

	Requested	Analyzed
Hydrogen		
Nitrogen	Bal.	Bal.
Argon		
Air		
Carbon Monoxide	5%	5.02%
Methane		
Oxygen	12.5%	12.5%
Helium		
Carbon Dioxide	12.5%	12.46%
	Total	



**1451 THORNE RD.
TACOMA, WA 98421
TEL: (253) 383-3637**

THE ONLY LIABILITY OF THIS COMPANY FOR GAS WHICH FAILS TO COMPLY WITH THE ANALYSIS SHALL BE REPLACEMENT THEREOF BY THE COMPANY WITHOUT EXTRA COST.

**DO NOT REMOVE
THIS TAG**



Scott Specialty Gases

500 WEAVER PARK RD, LONGMONT, CO 80501

Phone: 303-442-4700

Fax: 303-772-7673

CERTIFICATE OF ANALYSIS: Interference-Free™ Multi-Component EPA Protocol Gas

Customer

ENERGY & ENV MEASUREMENT

C/O ED WADINGTON
3730 N. PELLEGRINO DR.
TUCSON, AZ 85749

Assay Laboratory

SCOTT SPECIALTY GASES
500 WEAVER PARK RD
LONGMONT, CO 80501

Project No.: 08-34136-001

P.O. No.: VERBAL

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards:
Procedure #G1; September, 1993.

Cylinder Number: ALM052285

Certification Date: 4/21/97

Exp. Date: 4/21/2000

Cylinder Pressure***: 1998 PSIG

COMPONENT

SULFUR DIOXIDE *
NITROGEN

CERTIFIED

CONCENTRATION

506

PPM

BALANCE

ANALYTICAL ACCURACY*

+/- 1% NIST Traceable

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 1861	9/27/98	ALM059505	488.5 PPM	SO2/N2

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#

FTIR System/8220/AAB9400251

LAST DATE CALIBRATED

03/20/97

ANALYTICAL PRINCIPLE

Scott Enhanced FTIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad Analysis

Second Triad Analysis

Calibration Curve

SULFUR DIOXIDE *

Date: 04/14/97	Response Unit: PPM
Z1 = 0.3847	R1 = 487.72 T1 = 505.77
R2 = 488.75	Z2 = 1.8201 T2 = 505.88
Z3 = 1.8425	T3 = 505.78 R3 = 488.88
Avg. Concentration:	505.8 PPM

Date: 04/21/97	Response Unit: PPM
Z1 = 0.3241	R1 = 488.28 T1 = 505.43
R2 = 488.83	Z2 = 1.8098 T2 = 505.75
Z3 = 0.8340	T3 = 505.74 R3 = 488.88
Avg. Concentration:	505.8 PPM

Concentration = A + Bx + Cx2 + Dx3 + Ex4	
r = 0.999890	
Constants:	A = 0.000000
	B = 1.000000
	C = 0.000000
	D = 0.000000
	E = 0.000000

Special Notes:

ANALYST:

Devon VonFeldt
Devon VonFeldt

SO2 concentration analysis
05/14/03

Vm(std)	1.500			dscf=	1.500
mcf	1				
Hg	29.98				
DH	0.12				
temp	66	529		ppm =	510
ml BA ++	178				
Normality	0.0101			Run1	510
				Run 2	498
				Run3	507
Tank I.D. #	ALMO52285			avg.	505



AIR LIQUIDE

8832 DICE ROAD, SANTA FE SPRINGS, CALIFORNIA 90670 (562) 945-1383

CERTIFIED
ISO - 9002



CERTIFICATE of ANALYSIS

EPA Protocol Gases

Order Number: 62184	Cyl. Pressure: 2000PSIG	Lot Number: SFS34489	COMPONENT Name: Sulfur Dioxide Nitrogen	REQUESTED Concentration: 1260 ppm Balance	ASSAY Concentration: 1290 ± 20 ppm Balance
Assay Date: 01/29/01	Expiration Date: 01/29/04	Document Number: 7638112			
Customer: AIR LIQUIDE COMA, WA	P.O. Number: LOKKEE	Item Number:			

Mixture is valid only to 150 psig

EPA Protocol
Method No. 2.2, Procedure G-1

Analyst:
Approved by:

Thuan Tran
John Oliveri

GAS ANALYZER EMPLOYED
Manufacturer:
Model Number:
Serial Number:
Last Calibrated:
Analytical Principle:

Sulfur Dioxide

Horiba

CMA-331A

56674503

01/12/01

NDIR

REFERENCE STANDARD EMPLOYED FOR ANALYSIS

Concentration	Component	Balance	Cyl. No	Batch	Exp. Date	Sample No	Type
1540 ± 10 ppm	Sulfur Dioxide	Nitrogen	CC 62136	L99-029	12/02/01	GL	GMIS

ANALYSIS SUMMARY

	01/22/01	01/22/01	01/22/01	Sulfur Dioxide
	Triad 1	Triad 2	Triad 3	
Zero	0	0	0	Vdc
Reference	153	153	153	Vdc
Candidate	127	128	128	Vdc
Result	1278	1288	1288	ppm
Evaluation	VALID	VALID	VALID	
MEAN ANALYTICAL RESULT:				1285 ppm

	01/29/01	01/29/01	01/29/01	Sulfur Dioxide
	Triad 4	Triad 5	Triad 6	
Zero	0	0	0	Vdc
Reference	153	153	153	Vdc
Candidate	128	128	128	Vdc
Result	1288	1288	1288	ppm
Evaluation	VALID	VALID	VALID	
MEAN ANALYTICAL RESULT:				1288 ppm

Analyst:

Thuan Tran

Approved by:

John Oliveri



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
Cylinder Pressure***: 1880 PSIG

Certification Date: 4/21/97

Exp. Date: 4/21/2000

COMPONENT

SULFUR DIOXIDE *
NITROGEN

CERTIFIED
CONCENTRATION
1,770 PPM
BALANCE

ANALYTICAL ACCURACY**
+/- 1% NIST TRACEABLE

*** 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-1898	7/03/98	ALM057797	3131. PPM	SULFUR DIOXIDE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#
FTIR System/8220/AA89400251

LAST DATE CALIBRATED
03/20/97

ANALYTICAL PRINCIPLE
Scott Enhanced FTIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)
First Triad Analysis Second Triad Analysis Calibration Curve

SULFUR DIOXIDE *

Date: 04/14/97 Response Unit: PPM
Z1 = 0.7210 R1 = 3127.7 T1 = 1767.1
R2 = 3131.7 Z2 = 4.6770 T2 = 1768.1
Z3 = 4.6770 T3 = 1768.1 R3 = 3133.7
Avg. Concentration: 1768. PPM

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

Concentration = A + Bx + Cx2 + Dx3 + Ex4
r = 0.999950 1898
Constants: A = 0.00000
B = 1.00000 C = 0.00000
D = 0.00000 E = 0.00000

Special Notes:

ANALYST:

Devon Von Feldt
DEVON VONFELDT

SO2 concentration analysis
05/14/03

Vm(std) 1.500

mcf 1

Hg 29.98

DH 0.12

temp 66

ml BA ++ 617

Normality 0.0101

dscf=

1.500

ppm =

1767

Run1 1787

Run 2 1764

Run3 1767

avg.

1773

Tank I.D. # ALMO49127

Certificate of Analysis

ANALYTICAL CONTROL LABORATORY ANALYSIS METHYLENE CHLORIDE - OPTIMA

Catalog No. D151
Lot No. 035941

July 23, 2003

This is to certify that this lot was tested and found to comply with the specifications for this product.
The following are the actual analytical results obtained:

TESTS

Assay
Color
Description
Free Halogens
Identification
Fluorescence Background (as Quinine Sulfate)
Certified for EPA Test #1625
Pesticide Residue Analysis (as Heptachlor Epoxide)
Density (g/ml) at 25°C
Optical Absorbance At 254 nm
 At 240 nm
 At 233 nm

Refractive Index at 25°C
Residue after Evaporation
Titratable Acid
Preservative (Amylene)
Water (H₂O)

ACTUAL ANALYSIS

99.9%
5 APHA
Clear, Colorless Liquid
Pass Test
Pass Test
Not more than 1 ppb
Pass Test
Not more than 10ng/l
1.317.
0.002
0.10
0.54
1.4209
0.4 ppm
0.00004 Meq/g.
64 ppm
0.008%



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 ACETONE - OPTIMA

Catalog No. A929

June 4, 2002

Lot No. 023283

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

Assay
Color
Description
Identification
Fluorescence Background (as Quinine Sulfate)
Pesticide Residue Analysis
(As Heptachlor Epoxide)
Substances Reducing Permanganate
Solubility in Water
Aldehyde (as HCHO)
Density (g/ml) @ 25 Degrees C
Methanol (CH₃OH)
Isopropyl Alcohol ((CH₃)₂CHOH)
Optical Absorbance At 400 - 350 nm
At 350 nm
At 340 nm
At 330 nm
Refractive Index at 25°C
Residue after Evaporation
Titratable Acid
Titratable Base
Water (H₂O)

ACTUAL ANALYSIS

99.6%
5 APHA
Clear, Colorless Liquid
Pass Test
Not More Than 1 ppb
Not More Than 10 ng/L

Pass Test
Pass Test
0.0005%
0.7849
0.03%
0.01%
0.001
0.004
0.05
0.67
1.3566
0.4 ppm
0.0003 Meq/g
<0.0001 Meq/g
0.3%

Approved By: Robert Dowd
Robert Dowd
Q.C. Laboratory Manager



Chemical Division
1 Reagent Lane
Fair Lawn, N.J. 07410
201-796-7100

KEITHLEY

Keithley Instruments, Inc.
28775 Aurora Road
Cleveland, Ohio 44139
(440) 248-0400
Telefax: (440) 248-6168

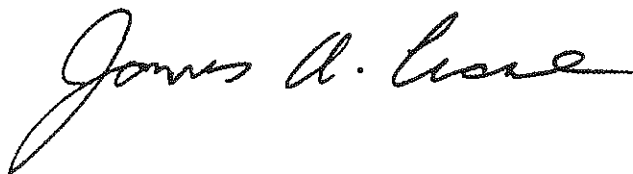
Certificate of Calibration

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

Appendix A

EXAMPLE CALIBRATION/DATA FLOW

All individual test run raw data sheets are organized in a manner that would allow a data reviewer to follow the data as it is being calculated in a step by step fashion. In many cases, the equations used to calculate a specific required data are given on the raw data sheets themselves.

For example, the particulate emission rate in g/dscf is calculated on Data Sheet #7. However, the data used to derive this data begins on Data Sheet #2 (Meterbox Data Sheet) where the meter volume (cubic feet), average meter temperature ($^{\circ}\text{F}$), 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):

$$V_{m(\text{std})} = \frac{V_m * 17.65 * \text{mcf} * \left(P_{\text{bar}} + \frac{\Delta H}{13.6} \right)}{T_m}$$

Volume of Water:

$$V_{w(\text{std})} = (0.04707)(\text{ml H}_2\text{O})$$

Moisture Content:

$$B_{ws} = \left(\frac{V_w}{V_w + V_{m(\text{std})}} \right) * 100$$

Dry Burn Rate:

$$\text{Br} = \left(\frac{\text{Wwt} - (\text{Wwt} * \% \text{H}_2\text{O})}{2.2046} \right) * \frac{60}{\theta}$$

Carbon Balance (N_t):

$$N_t = \frac{K_3 N_c}{(Y_{CO_2} + Y_{CO} + Y_{HC})}$$

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 H₂O (in. H₂O).
- K₃ = 1.0 lb/lb (English)
1000 g/kg (metric)
- K₄ = 0.02406 dsm³/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 $\pm 1.0\%$
 Temperatures are monitored using two type K thermocouples.

Appendix A

8

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 MSH 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 SO₂ 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:	$\pm 5\%$ 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 ($^{\circ}\text{F}$) 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 ($^{\circ}\text{F}$). 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 ($\pm 2.0\%$) 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" MSH 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 MSH 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 $\pm 1.0\%$.

8. CO₂ Analyzer

Horiba PIR 2000/SN 407069

The CO₂ analyzer is also a NDIR and is operated in exactly the same manner as the CO analyzer. The range of the CO₂ analyzer is 0-25.0% CO₂.

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 (CO₂, O₂ and CO) analyzer data and the SO₂ 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 $\pm$ 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 (SO₂) EQUIPMENT

1. SO₂ 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 SO₂ injection rotameter with Sweglock fittings. The loop is inserted in the stack at 9.5 $\pm$ 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 SO₂, 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 $1425 \text{ °F} \pm 25 \text{ °F}$.
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 MSH 3" or 4" filter.
10. SO₂ 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 SO₂ at a resolution of ± 25.0 ppm. The manufacturer's specification for linearity is $\pm 1.0\%$. 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 SO₂ 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 SO₂ analyzer is 1.5 SCFH.
12. Wait until the zero gas has completely flushed the train.
13. Record the zero gas reading. Record the SO₂ 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 SO₂ 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 SO₂ injection train and the pump for the tracer gas train.

B. Operation

1. Turn on the tube furnace to insure furnace is at approximately 1425 °F when the test begins.
2. Approximately 15-20 minutes before the actual start of the test, turn on the cylinder of pure SO₂.
3. Using the rotameter's current calibration, adjust the SO₂ flow rate to the calibrated level.
4. Turn on the pump in the tracer gas train. Adjust the flow rate through the SO₂ analyzer so that it remains at 1.5 SCFH.

5. Monitor the SO₂ 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 SO₂ analyzer output in volts and the stack gas SO₂ 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) SO₂ 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 SO₂ analyzer is 1.5 SCFH.
9. Wait until the zero gas has completely flushed the train.
10. Record the zero gas reading. Record the SO₂ 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 SO₂ 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 SO₂ 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 SO₂ concentrations in the ranges normally encountered during wood stove testing.

4. Sample flue gas with SO₂ 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 SO₂ concentrations are as stable as possible.
5. Remove the probe from the stack, noting the exact SO₂ 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 SO₂ levels begin to decline.
7. Continue observing the stop watch and DVM. Record the time when the SO₂ 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 (SO₂) 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 $\pm$ 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 (MSH) 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.

