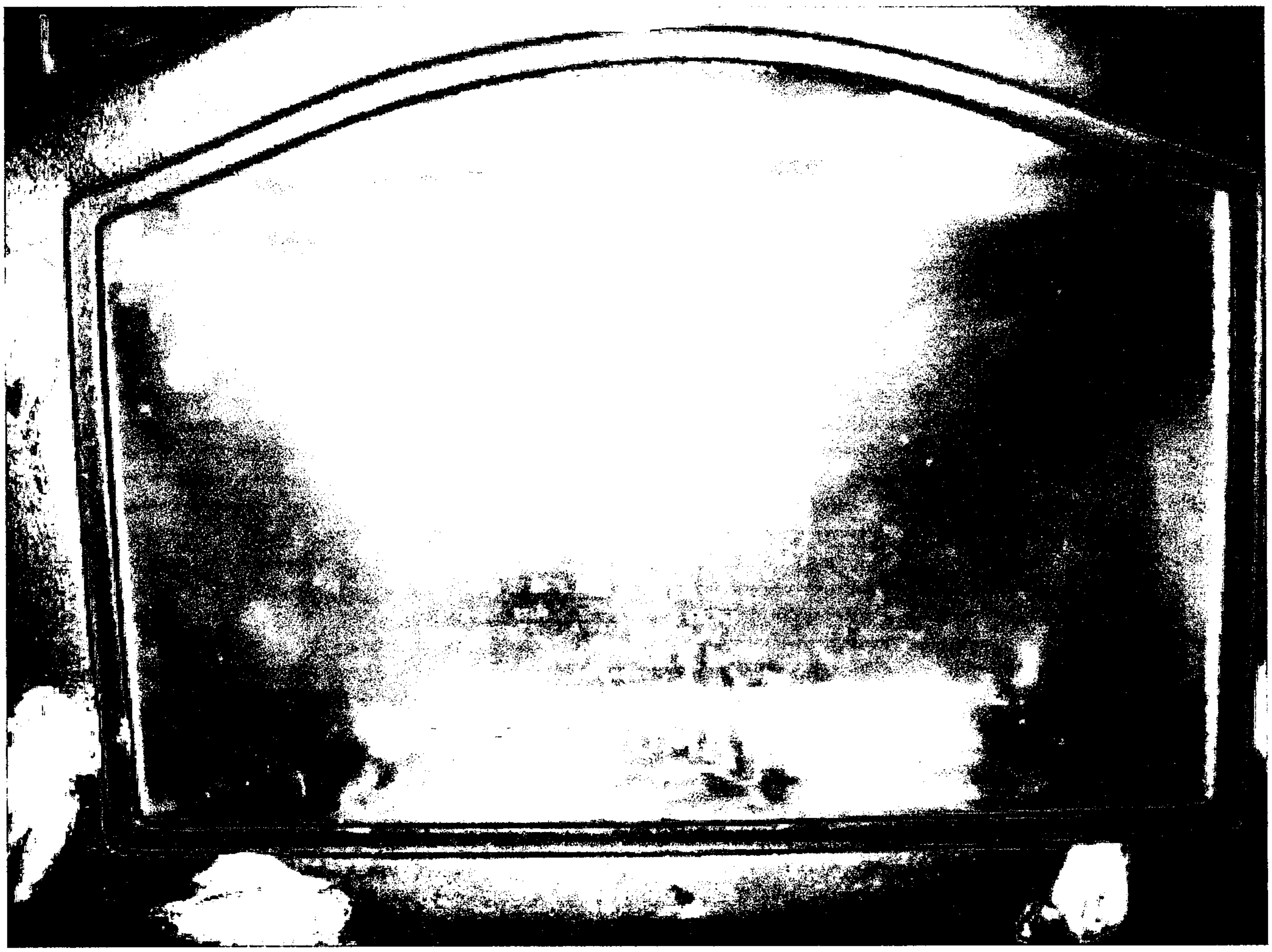
US EPA WOOD HEATER CERTIFICATION TEST REPORT

KUMA STOVES, INC.
KUMA ASHWOOD
NONCATALYTIC WOOD HEATER

MARCH 28, 2009



MYREN CONSULTING, INC.

OFFICE

512 WILLIAMS LAKE ROAD
COLVILLE, WA 99114
PHONE 509-684-1154
FAX 509-685-2262

LABORATORY

501 C WILLIAMS LAKE ROAD
COLVILLE, WA 99114
PHONE 509-685-9458
EMAIL bmyren@plix.com

WST5 Form 5148702
Rev 1/88

* * * * * * *

CONFIDENTIAL

* * * * * * *

The data and information in this test report is confidential, proprietary information and is not to be released to and/or discussed with any party who is not authorized by the manufacturer or the testing laboratory to receive such data.

* * * * * * *

CONFIDENTIAL

* * * * * * *

Photos: This section contains two photographs of the fuel load for each test run and two color photographs (side and front view) of the wood heater tested and any other photographs pertinent to testing the unit.	Photos	vari

TABLE OF CONTENTS

FIELD OBSERVATION CHECKLIST

Unit Name: KUMA ASHWOOD

Manufacturer Name: KUMA STOVES, INC.

Manufacturer Address: 2150 W. HAYDEN AVE.
HAYDEN, ID 83835

Manufacturer Phone: 208 762 8002
Fax: 208 762 ~~5882~~ 5862

Observers & Affiliation: NONE

SUPERVISOR: BEN MYREN

MYREN CONSULTING'S LAB TEAM: JOHN PALM, ILSE MYREN, PAT GARVEY, BEN MYREN

LAB LOCATION: 501-C WILLIAMS LAKE ROAD, COLVILLE, WA 99114
LAB ELEVATION: 1645 FEET

MYREN CONSULTING, INC.

LABORATORY
501-C WILLIAMS LAKE ROAD
COLVILLE, WA 99114
509 685 9458

OFFICE
512 WILLIAMS LAKE ROAD
COLVILLE, WA 99114
509 684 1154
509 684 3987

v

REPORT CERTIFICATION

The sampling and analysis for the appliance described in this test report was carried out under my direction and supervision.

Date: 3/29/09 Signature: Albert V. Myren Jr.
Title: President

I have reviewed all of the test data and test results found in this test report and herby certify that the test report is authentic and accurate.

Date: 3/29/09 Signature: Albert V. Myren Jr.
Title: President

PAGE NUMBER INDEX

	Section	Location
1. Summary Table of Burn Rate and Emission Rate Results	Data Summary	Weight Avg Calc Sheet, pp.1-4
2. Summary Table of Other Data	Data Summary	Data Summary Sheets, pp 5-7
3. Wood Heater Description	Stove QC	Wood Heater Description, p.1 (vari)
4. Manufacturer's Testing Instructions	Operators Manual	P.1 of Section
5. Test Chamber Installation Description	Installation Description	P. 1
6. Wood Heater/Catalyst Aging Documentation	Stove/Cat Aging	
7. Wood Heater Dimensions and Useable Firebox Volume	Stove QC	
8. Pretest Burn Procedures	Individual Test Runs	Data Sheets #9,9A,9A-1,9A-2,13
9. Pretest Facility Measurements	Individual Test Runs	Data Sheets #8,16
10. Test Fuel Measurements		
A. Load Wt.	Individual Test Runs	Data Sheet #8
B. Load Moisture	Individual Test Runs	Data Sheet #10
C. Wood Density	Individual Test Runs	Data Sheet #11
11. Test Fuel Crib Description		
A. Photographs	Photographs	
B. Wood Type and Line Drawing	Individual Test Run	Data Sheet #9A,9A-1, or 9A-2
12. Test Run Heater Operation and Air Supply Settings	Individual Test Run	Data Sheets #9,9A,9A-1,9A-2,13
13. Calibrations		
A. Platform Scale		
1. Initial	Cal Data P. 1	
2. Semi Annual	Cal Data P. 2	
3. Pre and Post Test	Individual Test Run	Data Sheet #16

B. Analytical Balance		
1. Initial	Cal Data	P. 3
2. Semi Annual	Cal Data	P. 4
3. Pre Weighing Check	Individual Test Run	Data Sheet #4
C. Temperature		
1. Thermocouples	Cal Data	P.5
2. Thermocouple Readout		
a. Semi annual	Cal Data	P. 6
b. Daily Check	Individual Test Run	Data Sheet #16
3. Dry Gas Meter	Cal Data	P. 7
D. Anemometer	Cal Data	
E. Barometer	Cal Data	P. 11
F. Draft Gauge	Cal Data	P. 12
G. Humidity Gauge Calibration (Sling Psychrometer)	Cal Data	P. 13
H. Dry Gas Meter		
1. Initial	Cal Data	P. 14
2. Semi Annual	Cal Data	P. 15
3. Post Certification Test	Cal Data	P. 16
4. Transfer Standard Calibrarion	Cal Data	P. 17
5. Wet Test Meter Calibration	Cal Data	P. 18
J. Combustion Gas (CO_2, O_2, CO) Train Response Check	Cal Data	P. 20
L. CO Analyzer		
1. Calibration	Cal Data	P. 22
2. Zero/Span Control Chart	Cal Data	P. 23
3. Pre and Post Test Zero/Span	Individual Test Run	Data Sheet #15-3
M. CO_2 Analyzer		
1. Calibration	Cal Data	P. 24
2. Zero/Span Control Chart	Cal Data	P. 25
3. Pre and Post Test Zero/Span	Individual Test Run	Data Sheet #15-1
N. O_2 Analyzer (Optional)		
1. Calibration	Cal Data	P. 26
2. Zero/Span Control Chart	Cal Data	P. 27
3. Pre and Post Test Zero/Span	Individual Test Run	Data Sheet #15-2
P. Calibration Gas Certificates of Analysis		
1. The Pre and Post Test Zero/Span Audits	Individual Test Runs	Data Sheets #15-1,15-2,15-3,15-4

2. Method 3 Verification of Analysis (CO_2, O_2, CO, N_2)	Cal Data	P. 30-31
14. Quality Checks		
A. Leak Checks		
1. Particulate Sampling Train	Individual Test Runs	P. 1 of Data Sheet #2
2. Combustion Gas (CO_2, O_2, CO) (CEM) Train	Individual Test Runs	Data Sheet #16
B. Proportional Checks	Individual Test Runs	Table 1 Computer Printout
15. Sample Calculations		
A. Weighed Average Emission Rate	Data Summary	Weighted Average Calc Sheets, pp.1-3
B. Dry Burn Rate	Individual Test Runs	Data Sheet #8 Computer Printout
16. Raw Test Data	Individual Test Runs	Data Sheets 1 - 16
17. Analytical Data		
A. Filter and Beaker Tares	Individual Test Runs	Data Sheets #4-1, 4-2
B. Solvent Blanks	Individual Test Runs	Data Sheet #4-3,5-3
C. Particulate Catches		
1. Gross	Individual Test Runs	Data Sheets #5-1,5-2
2. Blanks	Individual Test Runs	Data Sheets #5-3
3. Net	Individual Test Runs	Data Sheet #6
D. Constant Weight Weighings	Individual Test Runs	Data Sheet #4-3

M5G-1 INDIVIDUAL TEST RUN PAGE INDEX
The Data Sheets in the individual test runs
Are organized in the following sequence.

A. Computer Printout(s)
Table 1 Field Data - Sampling Interval Data
Table 1 Field Data
Table 1 Field Data Averages
Table 1 Calculations
Table 1 Proportional Rate Variation

B. Raw Data Sheets

	# of Pages
Data sheet # 2 Meterbox Data Sheets	Variable
Data Sheet # 4 Analytical Balance Data Sheets	
# 4-1 Filter Tare Weights	Variable
# 4-2 Beaker Tare weights	Variable
# 4-3 Constant Final Weights	Variable
# 4-4 Scale QA Checks	Variable
Data Sheet # 5 Particulate Catch Processing Sheet	1
Data Sheet # 8 Miscellaneous Data Sheet	1
Data Sheet # 9 Stove Operating Data	1
Data Sheet # 9A PP. 1-4 Stove Operating Data	Variable
Data Sheet # 10 Fuel Moisture	1
Data Sheet # 11 Fuel Density	1
Data Sheet # 13 Pre Burn Data	Varaible
Data Sheet # 14 Burn Rate, Flue Gas & Temperature Data	Varaible
Data Sheet # 15 Pre & Post Test Zero/Span Audits	
# 15-1 CO_2	1
# 15-2 O_2	1
# 15-3 CO	1
Data Sheet # 16 Quality Checks	1

TEST SERIES INFORMATION AND DISCUSSION

Unit: Kuma Ashwoood Noncatalytic Wood Heater

Model: Ashwood

Manufacturer: Kuma Stoves, Inc.

Date Received: 2/12/09 Date(s) Aged: 2/12 & 13/09

Test Dates: 2/16, 17, 18, 19, 20, 27 & 3/2 2009

Sampling Method(s): EPA M5G-1

Fueling Protocol: EPA M28

Number of Test Runs: 7

The Kuma Ashwood Noncatalytic wood heater manufactured by Kuma Stoves, Inc. located in Hayden, ID was tested by Myren Consulting, Inc. using the Environmental Protection Agency's (EPA) Method 28, "Certification and Auditing of Wood Heaters", Method 5G-1, "Determination of Particulate Emissions from Wood Heaters from A Dilution Tunnel Location" and, if applicable, Method 28A, "Measurement of Air to Fuel Ratio and Minimum Achievable Burn Rates for Wood Fired Appliances". (See the Federal Register/ Vol.53,No.38/ Friday, February 26, 1988/ pp.5860-54926.) The particulate matter(PM) emission data, if reported, was calculated as specified in the Wood Heater New Source Performance Standard (NSPS).

All events and information pertinent to the test data are recorded on the data sheets for each test run, particularly on pp. 9, 9-1, 9-2, 9-3, 9-4 and 9-5 if present.

Any deviations made or noted form the promulgated methods other than those that were accepted and certified by EPA during the laboratory accreditation process are listed and discussed below.

A brief note about how the EPA M5G-1 particulate samples were processed is necessary to help the reviewer understand the net catch values. Experience has shown that the small portions of the filters that are left on the frits in the M5G-1 filter housing apparatus after the filters are removed are full of static electricity. When these small portions are removed to a plastic petri dish, they quickly adhere to the dish. Trying to recapture this material during weighing causes it to disintegrate into smaller and smaller pieces, which makes obtaining accurate catch weights difficult. Thus, it was decided to place this filter material in with the particulate captured with the acetone wash, where it shows up as catch. Some of the filter material was already following this pathway. Thus, there may be negative filter catch weights, particularly for the back half filter, that are used during the particulate emission rate calculation process. However, the filter material lost off the filters is accounted for in the acetone catch.

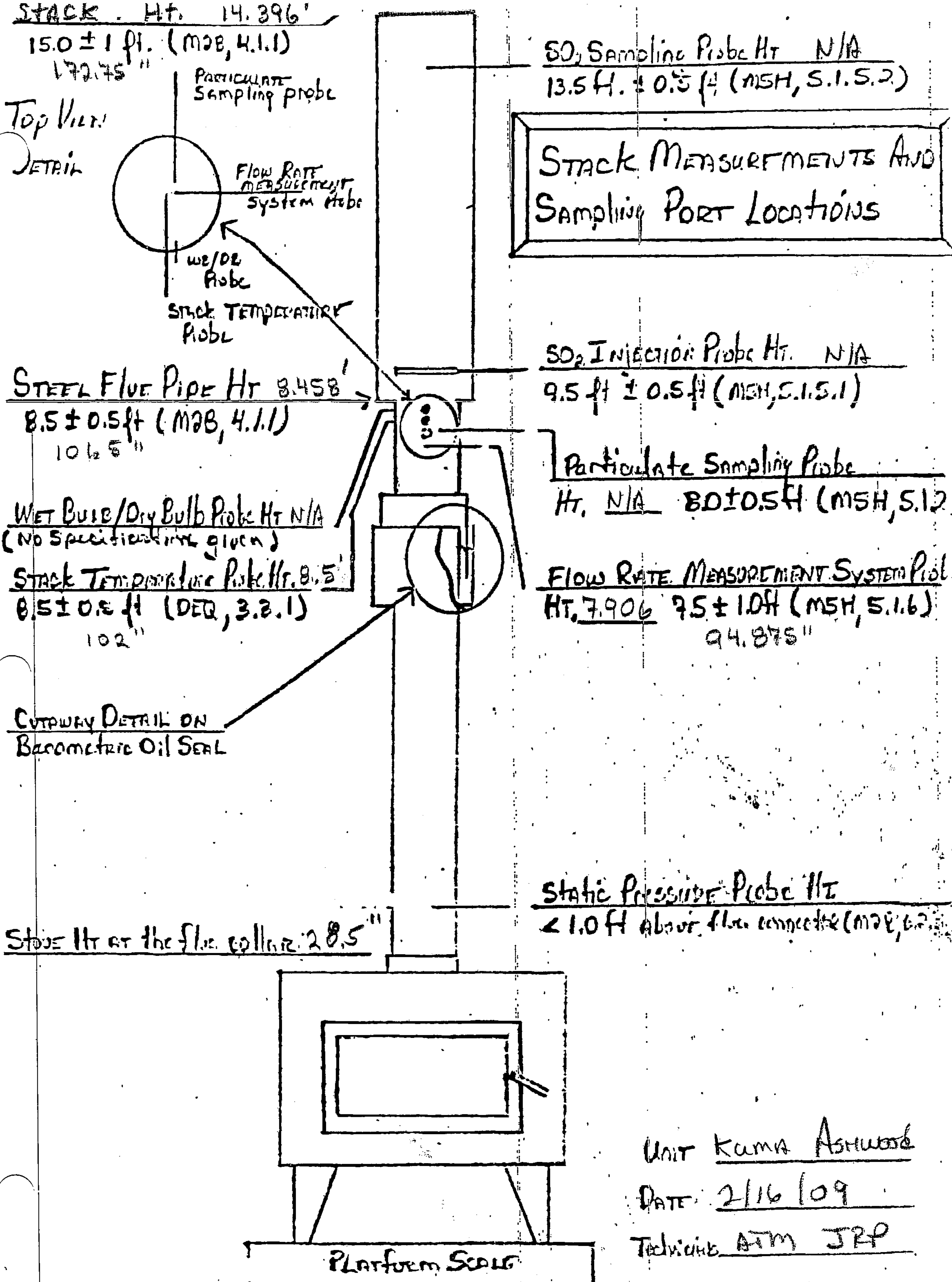
The following pages contain (1.) a diagram showing the height of the appliance and black pipe and Class A chimney and the location of the sampling ports in the chimney and (2.) a diagram of the EPA 6″ diameter dilution tunnel used by Myren Consulting during testing, (3.) a copy of the letter requesting a waiver from the 30 day certification test notification requirement, (4.) a copy of the fax machine's output indicating that the fax had been received by EPA and (5.) a discussion of results.

DISCUSSION:

(1.) The first Medium Low (1.0-1.25 kg/hr) test (Run 5) had emissions that were higher than expected. There was a break between Run 5 and Runs 6 & 7 because we waited for a final constant weight for the filters and beaker for Run 5 so that we knew for certain that the extra runs were really necessary. The manufacturer wanted the weighted average emission rate for the Ashwood to be below 4.0 g/hr if at all possible.

(2.) The way the test results are calculated has changed slightly. The average tunnel gas velocity was calculated using the square root of the average of the Δp readings. Now the tunnel gas velocity is calculated using the average of the square roots of the Δp readings and the average static pressure (Pg) reading. This change is based upon comments made by Mr. Mike Toney of OAQPS, EPA, RTP, NC.

Stack Measurements And Sampling Port Locations



Unit Kuma Ashwood

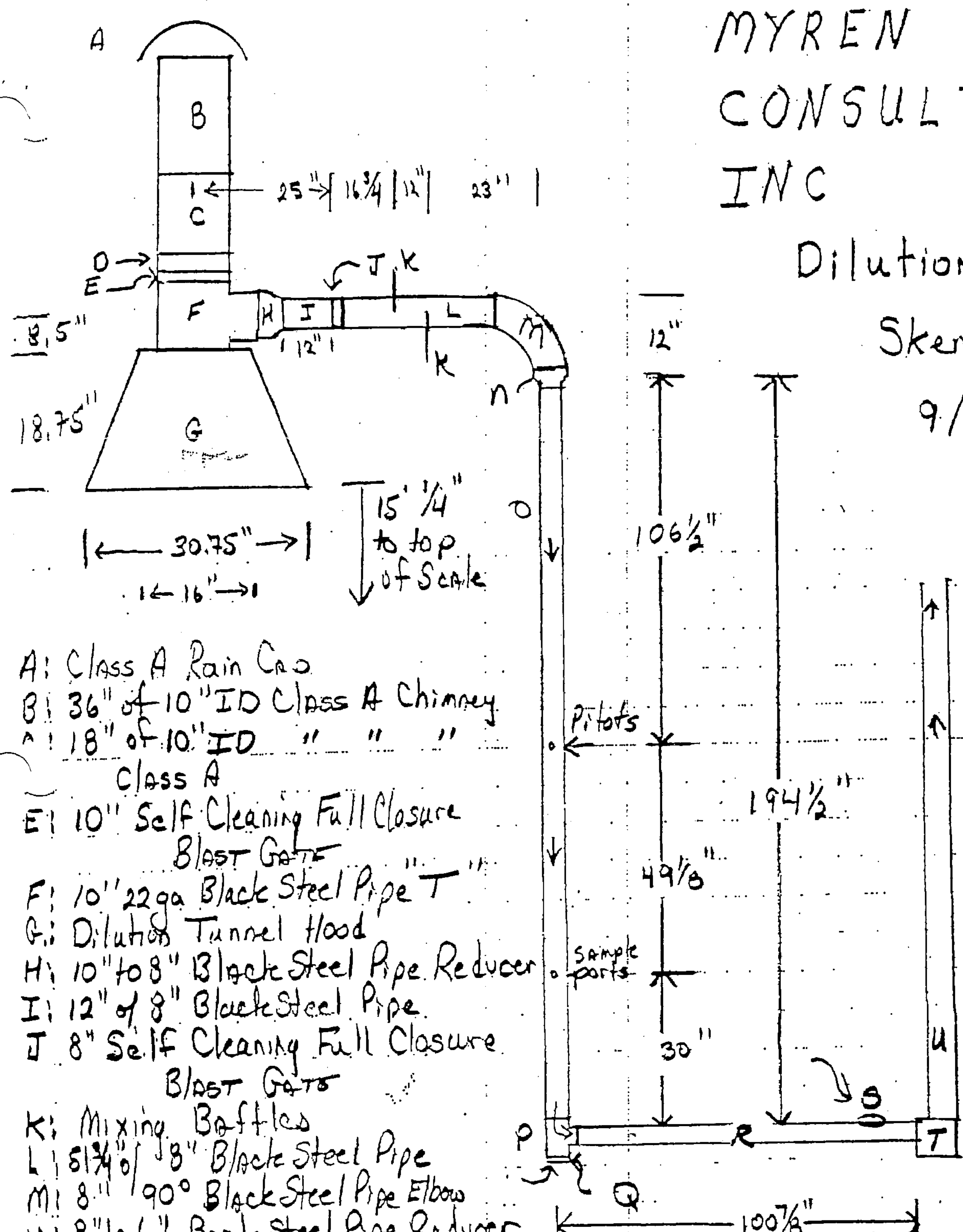
Date 2/16/09

Technician ATM JRP

MYREN CONSULTING INC

Dilution Tunnel Skematic

9/9/97



A: Class A Rain Cap

B: 36" of 10" ID Class A Chimney

C: 18" of 10" ID " " " Class A

E: 10" Self Cleaning Full Closure Blast Gate

F: 10" 22ga Black Steel Pipe "T"

G: Dilution Tunnel Hood

H: 10" to 8" Black Steel Pipe Reducer

I: 12" of 8" Black Steel Pipe

J 8" Self Cleaning Full Closure Blast Gate

K: Mixing Baffles

L: 51¾" of 8" Black Steel Pipe

M: 8" 90° Black Steel Pipe Elbow

N: 8" to 6" Black Steel Pipe Reducer

O: 194½" of Black Steel Pipe

P: 6" Black Steel Pipe T Section

Q: 6" Self Cleaning Full Closure Blast Gate (for adjusting flows)

R: 100⅞" 6" Black Steel Pipe

S: 2¼" diameter Bleed Hole

T: Dayton Blower

U: 6" Black Steel Pipe (Exhaust)

Not to Scale

Dimensions shown are actual

Total Tunnel Length - 22.635'

Myren Consulting, Inc.
512 Williams Lake Road
Colville, WA 99114

Office: (509)684-1154 Lab: (509)685-9458
Fax: (509)685-2262 email: <bmyren@plix.com>

Date: 14 February 2009

To: John Dupree

From: Ben Myren

RE: Request for a Thirty Day Certification Test Notification Waiver for the Kuma Ashwood Noncatalytic Woodheater

Friday Myren Consulting was asked by Mr. Mark Freeman of Kuma Stoves, Inc. if we would be able to conduct a certification test series on the Kuma Ashwood noncatalytic stove that Kuma has been developing and they believe is now ready for certification testing. R&D test results at our lab confirm this. So we are ready to start the certification series. Myren Consulting has the time available to conduct the test series, so granting the waiver would be beneficial to all parties, especially since the HPBA Expo is just a little over a month away. We would like to start the EPA test series on the Kuma unit starting on Monday, February 16, 2009 and then finish the series as quickly as possible. I intend to call to confirm the arrival of this fax and that the waiver has been granted. I am also emailing you this waiver request.

Regards and Thank You, Ben Myren

P. 1

* * * COMMUNICATION RESULT REPORT (FEB.16.2009 10:57AM) * * *

TTI

FILE MODE	OPTION	ADDRESS (GROUP)	RESULT	PAGE
675 MEMORY TX		101081112025640050	OK	P. 1/1

REASON FOR ERROR
E-1) HANG UP OR LINE FAIL
E-3) NO ANSWER
E-2) BUSY
E-4) NO FACSIMILE CONNECTION

Myren Consulting, Inc.

512 Williams Lake Road
Colville, WA 99114
Office: (509)684-1154 Lab: (509)685-9458
Fax: (509)685-2262 email: <bmyren@plix.com>

Date: 14 February 2009

To: John Dupree

From: Ben Myren

RE: Request for a Thirty Day Certification Test Notification Waiver for the Kuma Ashwood Noncatalytic Woodheater

Friday Myren Consulting was asked by Mr. Mark Freeman of Kuma Stoves, Inc. if we would be able to conduct a certification test series on the Kuma Ashwood noncatalytic stove that Kuma has been developing and they believe is now ready for certification testing. R&D test results at our lab confirm this. So we are ready to start the certification series. Myren Consulting has the time available to conduct the test series, so granting the waiver would be beneficial to all parties, especially since the

EPA WEIGHTED AVERAGES CALCULATIONS
EPA WEIGHTED AVERAGE PARTICULATE EMISSION RATE

The weighted average particulate emission rate ($\overline{PM}$) for the Kuma Ashwood Noncatalytic Wood Heater manufactured by Kuma Stoves, Inc. of Hayden, ID is 3.50 g/hr.

EPA WEIGHTED AVERAGE OVERALL EFFICIENCY

The weighted average overall efficiency ($\overline{OE}$) for the Kuma Ashwood is (default) 63 %.

II. EPA TEST RESULTS
* Denotes runs used in weighted average calculations

Run #	Dry Burn Rate/kg/hr	Grams/Hour	Overall Efficiency
4	0.947	4.5244	
7	1.059	2.8534	
6	1.199	2.9311	
2	1.433	2.3332	
1	2.332	4.7518	
3[1]	1.233	1.7596	
5[2]	1.102	4.6078	

III. EPA CUMULATIVE PROBABILITY CALCULATIONS

$$P_n = \frac{[\text{Hi Prob.} - \text{Low Prob.}][\text{Act. Dry Burn Rate} - \text{Low Dry Burn Rate}]}{.05} + \text{Low Prob.} = P_n$$

	Hi Prob.	Low Prob.	Act. Dry Burn Rate	Low Dry Burn Rate	Low Prob.	P_n
P_1	.328	.300	0.947	.900	.300	.32632
P_2	.460	.407	1.059	1.050	.407	.41654
P_3	.550	.490	1.199	1.150	.490	.54880
P_4	.722	.695	1.433	1.400	.695	.71282
P_5	.951	.945	2.332	2.300	.945	.94884
P_6						
P_7						
P_8						
P_9						
P_{10}						
P_{11}						
P_{12}						
P_{13}						
P_{14}						
P_{15}						

$K_1 = P_2 - P_0 =$	.41654	-	.000	=	.41654
$K_2 = P_3 - P_1 =$	.54880	-	.32632	=	.22248
$K_3 = P_4 - P_2 =$	.71282	-	.41654	=	.29628
$K_4 = P_5 - P_3 =$	.94884	-	.54880	=	.40004
$K_5 = P_6 - P_4 =$	1.0000	-	.71282	=	.28718
$K_6 = P_7 - P_5 =$		-		=	
$K_7 = P_8 - P_6 =$		-		=	
$K_8 = P_9 - P_7 =$		-		=	
$K_9 = P_{10} - P_8 =$		-		=	
$K_{10} = P_{11} - P_9 =$		-		=	
$K_{11} = P_{12} - P_{10} =$		-		=	
$K_{12} = P_{13} - P_{11} =$		-		=	
$K_{13} = P_{14} - P_{12} =$		-		=	
$K_{14} = P_{15} - P_{13} =$		-		=	
$K_{15} = P_{16} - P_{14} =$		-		=	

IV. EPA WEIGHTED AVERAGES CALCULATIONS

The following formula is the one set out in Equation 28-1, Section 8.1, Method 28 and is to be used to calculate both the weighted average particulate emission rate (PM) and the weighted average overall efficiency (OE) as shown below. The formula uses interpolated probabilities for a given heat output demand calculated from the values listed in Table 28-1(2) in Method 28.

$$\overline{PM} = \frac{K_1PM_1 + K_2PM_2 + K_3PM_3 + \ldots K_nPM_n}{K_1 + K_2 + K_3 \ldots + K_n}$$

Where $\overline{PM}$ = The EPA weighted average particulate matter (PM) emission rate in grams per hour (g/hr).
$K_1, K_2, K_3, \ldots K_n$ = The weighting factors for the individual test runs as determined in III above.
$PM_1, PM_2, PM_3, \ldots PM_n$ = The particulate emission rates for the individual test runs as listed in II above.

And

$$\overline{OE} = \frac{K_1OE_1 + K_2OE_2 + K_3OE_3 + \ldots K_nOE_n}{K_1 + K_2 + K_3 + \ldots K_n}$$

Where $\overline{OE}$ = The EPA weighted average overall efficiency in percent (%).
$K_1, K_2, K_3, \ldots K_n$ = The weighting factors for the individual runs as determined in III above.
$OE_1, OE_2, OE_3, \ldots OE_n$ = The overall efficiencies for the individual test runs as listed in II above.

IV.A. EPA WEIGHTED AVERAGE PARTICULATE EMISSIONS CALCULATIONS

$$\overline{PM} = \frac{.41654(4.5144)+.22248(2.8534)+.29628(2.9311)+.40004(2.3332)+.28718(4.7518)+(\ )+(\ )+}{.41654+.22248+.29628+.40004+.28718+\ +\ +}$$

$$\frac{(\ )+(\ )+(\ )+(\ )+(\ )+(\ )+(\ )}{+\ +\ +\ +\ +\ +} =$$

$$\overline{PM} = \frac{1.88459+.63482+.86843+.93337+1.36462+\ +\ +\ +\ +\ +\ +\ +\ +}{1.62252} =$$

$$\overline{PM} = \frac{5.68583}{1.62252} = 3.50432 = 3.50 \text{ g/hr}$$

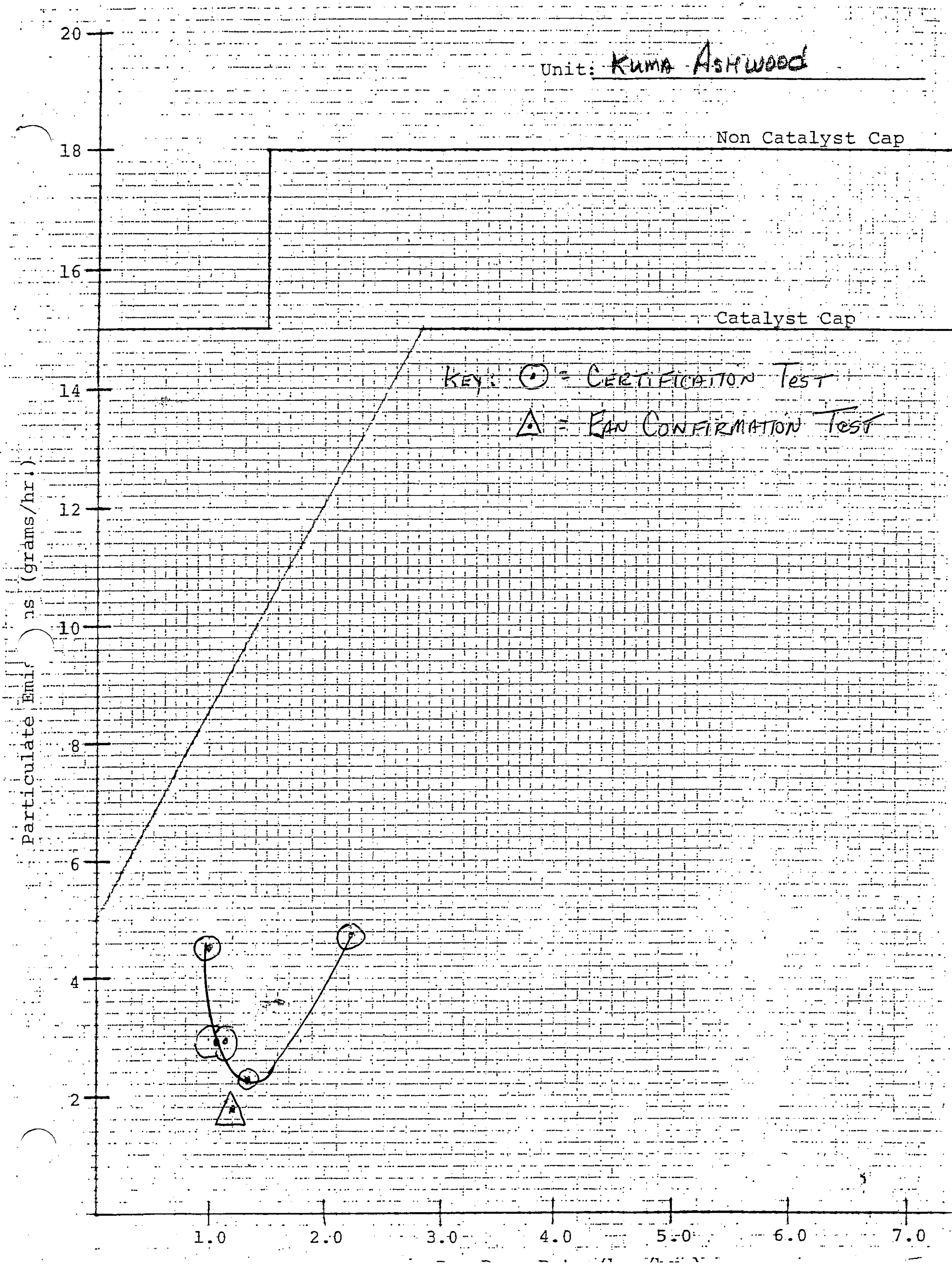
IV.B. EPA WEIGHTED AVERAGE OVERALL EFFICIENCY CALCULATIONS

$$\overline{OE} = \frac{(\ )+(\ )+(\ )+(\ )+(\ )+(\ )+(\ )+}{+\ +\ +\ +\ +\ +\ +}$$

$$\frac{(\ )+(\ )+(\ )+(\ )+(\ )+(\ )+(\ )}{+\ +\ +\ +\ +\ +} =$$

$$\overline{OE} = \frac{+\ +\ +\ +\ +\ +\ +\ +\ +\ +\ +\ +\ +}{\quad} =$$

$$\overline{OE} = \frac{\quad}{\quad} = \underline{\quad} = \underline{\quad}\ \%$$


Unit: Kuma Ashwood
Non Catalyst Cap
Catalyst Cap
KEY: ⊙ = Certification Test
△ = EAN Confirmation Test
Particulate Emi
ns (grams/hr.)
20
18
16
14
12
10
8
6
4
2
1.0
2.0
3.0
4.0
5.0
6.0
7.0

Woodstove Data Summary

Run #	4	7	6	2	1		3[1]	5[2]	
Particulate Emissions:									
Concentration: grains/dscf:									
grams/m^3:									
Emission Rate: grams/hr:	4.5244	2.8534	2.9311	2.3332	4.7518		1.738	6.365	
Emission Factor: gms/kg: (dry fuel weight basis)	3.1625	1.6239	1.4807	0.7672	1.3628		0.7670	4.0995	
Front Half Catch: % of total					32.91				%
Total Mass Captured: Frt. & Bck Halves:	56.5	29.0	25.4	13.5	23.7		11.7	73.1	mg
Efficiency Valves:									
Overall Appliance Efficiency									%
Combustion Efficiency									%
Heat Transfer Efficiency									%
Heat Output:									
Avg. BTU/hr for test cycle (EPA)	11,420	12,765	14,460	17,275	28.120		14,866	13,293	BTU/h
Fuel Burn Rates:									
Avg Kg/hr for test cycle (Wet basis)	1.132	1.273	1.449	1.724	2.809		1.478	1.319	Kg/hr
Avg Kg/hr for test cycle (Dry basis)	0.947	1.059	1.199	1.433	2.332		1.233	1.102	Kg/hr

Notes: 1 = Run 3 = Fan Confirmation Test
2 = Run 5 was replaced by 6 & 7

Unit: Kuma Ashwood

RUN #	4	7	6	2	1		3	5	
Fuel Moisture Content:									
Kindling (Wet basis)	8.606	7.345	7.593	7.749	8.369		8.523	7.905	%
Pretest Fuel (Wet basis)	17.487	17.168	17.501	17.301	17.022		17.781	17.305	%
Test Fuel (Wet basis)	16.309	16.838	17.2642	16.921	16.976		16.602	16.449	%
Air/Fuel Ratio:									
lbs air/lbs fuel									
Average Stack Gas Composition:									
Avg. % CO_2									%
Avg. % O_2									%
Avg. % CO									%
Avg. % Excess Air									%
Avg. % Moisture									%
Average Stack Gas Flow Rate:									
Stack flow rate - EPA CMB									dscfm
CHO balance									dscfm
Tracer Gas									dscfm
Draft (Static)	-.032	-.038	-.041	-.043	-.061		-.041	-.037	in. H_2O
Proportionality - Average	96.592	97.453	100.111	95.756	95.983		96.974	98.033	
Average Stack Gas Emission Factors:									
CO - g/Kg									
g/hr									

RUN #	4	7	6	2	1		3	5	
Average Temperatures:									
Stack Gas	228	264	289	298	480		271	238	°F
Primary Combustion Chamber Gas	691	741	776	851	990		809	731	°F
Secondary Combustion Chamber Gas	959	1013	1035	1102	1219		1062	971	°F
Catalytic Combustor Exit Gas	N/A	N/A	N/A	N/A	N/A		N/A	N/A	°F
Stove Top	469	493	520	587	627		576	408	°F
Stove Left Sidewall	428	460	478	522	541		505	450	°F
Stove Back	310	347	353	414	329		379	344	°F
Stove Right Sidewall	420	444	457	508	513		487	435	°F
Stove Bottom	290	301	310	340	302		326	306	°F
Stove Temperature Change	-111.2	-100.6	-91.4	-63.8	-97.0		-86.8	-84.0	°F
Test Chamber Environment:									
Avg. Barometric Pressure	28.521	28.138	28.728	28.224	28.153		28.511	28.551	in Hg
Avg. Temperature	80	77	75	82	81		77	79	°F
Avg. % Ambient Moisture	1.175	1.20	1.00	1.05	1.175		.875	1.10	% H_2O
Avg. % Relative Humidity	42.0	43.5	33.5	33.0	37.5		52.0	34.5	%RH
Avg. Air Velocity	00.0	00.0	00.0	00.0	00.0		00.0	00.0	m/sec
Avg. Dilution Tunnel Draft (If Applicable)	.000	.000	.000	.000	.000		.000	.000	in/H_2O
Test Fuel Weight and Burn Time:									
Density (Dry basis)	0.3685	0.4546	0.4704	0.4265	0.4329		0.3748	0.4213	gm/cm³
Coal Bed Weight	3.3	2.9	2.7	3.1	2.8		2.9	3.0	lbs.
Pre Test Fuel Wt (Inc Kindling)	40.658	40.726	41.478	40.252	43.048		38.510	40.716	lbs.
Test Fuel Load Weight	13.808	13.330	13.314	13.306	13.210		13.308	13.332	lbs.
Total Test Cycle Burn Time	320	285	250	210	128		245	275	min.

Unit Kuma Ashwood
Date 2/12-13/2009
Technicians ATM JRP PDG
Page 1 of 1
WST5-Form3

CATALYTIC COMBUSTOR AGING DATA
OR
STOVE AGING DATA
WOODSTOVE TEST DATA SHEET #25

Hr. #	Date	Time (T/C#)	Firebox Temp (9)	Secondary Burn Temp (10)	Post Cat	In Cat	Comments	
1	2/12/09	1250	806	1256			Fire Started 0821	
2		1350	853	1251				
3		1450	781	1002			From DAS Line 53	99
4		1550	679	779			From DAS Line 65	99
5	↓	1650	565	656				
6	2/13/09	1015	938	1395			Fire Started 0756	
7		1115	919	1000				
8		1215	715	1325				
9		1315	961	116				
10		1415	761	859			From DAS Line 89	100
11	↓	1515	666	727				

EF OW

MYREN CONSULTING CERTIFICATION TEST DATA

DILUTION TUNNEL CALCULATIONS

1\25\09, Md=28.56, Bws=4%

	6" Tunnel	RUN TIME (min)	PITOT DELTAP (- INCH H20)	TNL TEMP (°F)	GAS METER RDG (ft3)	GAS METER TEMP (°F)	GAS METER DELTA H (in.H2O)	TUNNEL VELOCITY (ft/min)	PROP RATE (%)	dDGM vol std (ft3)	Tunnel Static (- Inch H2O)	SQUARE ROOT DELTA P	DRY GAS METER RDG (m3)
File Name:	EPA 4												
Manufacturer:	KUMA												
Model Number:	ASHWOOD												
Lab Name:	MYREN												
Test Date:	2\19\09	0	0.041	97	288.4130	72	0.900	850.45			0.161	0.2025	
Run Number:	EPA 4	10	0.039	106	293.7030	75	0.900	836.12	105.3	5.074	0.157	0.1975	
Meter Box Y Factor:	1.0177	20	0.040	98	298.9510	78	0.900	840.76	101.3	5.006	0.153	0.2000	
Barometric pressure (in):	28.521	30	0.040	96	304.1800	81	0.900	839.25	99.6	4.960	0.154	0.2000	
Gas meter temp (ave):	**90**	40	0.039	98	309.3890	84	0.900	830.19	99.6	4.914	0.153	0.1975	
delta H(avg):	**-0.900**	50	0.039	99	314.6090	86	0.900	830.93	99.1	4.906	0.154	0.1975	
Gas meter initial reading:	288.4130	60	0.039	99	319.8170	88	0.900	830.93	98.2	4.877	0.153	0.1975	
Gas meter final reading:	457.0270	70	0.039	99	325.0480	89	0.900	830.93	98.3	4.890	0.154	0.1975	
Front catch (acetone) mg:	5	80	0.040	99	330.2800	90	0.900	841.52	96.7	4.882	0.154	0.2000	
first filter catch (mg):	51.8	90	0.039	98	335.5320	90	0.900	830.18	98.2	4.901	0.151	0.1975	
second filter catch (mg):	-0.3	100	0.041	98	340.7890	91	0.900	851.22	95.5	4.896	0.161	0.2025	
Tunnel Flow (Qsd) (dscfm)	**139.094**	110	0.041	96	346.0520	92	0.900	849.69	95.1	4.893	0.162	0.2025	
Emission Rate(g/hr):	**2.996**	120	0.041	96	351.3220	92	0.900	849.69	95.2	4.900	0.163	0.2025	
Emission Rate(M5H) :	**4.524**	130	0.041	94	356.6010	92	0.900	848.16	95.2	4.908	0.163	0.2025	
Avg. of Delta P Sq. Roots:	**0.1994**	140	0.042	93	361.8750	92	0.900	857.67	93.9	4.903	0.163	0.2049	
Vs (Avg.)(ft/min):	**814.153**	150	0.041	93	367.1600	92	0.900	847.39	95.3	4.914	0.162	0.2025	
Tunnel Avg. Temperature (F):	**94.939**	160	0.041	93	372.4420	92	0.900	847.40	95.2	4.911	0.163	0.2025	
Test time(min):	320	170	0.040	94	377.7300	92	0.900	837.75	96.6	4.916	0.163	0.2000	
Fuel Load(lb. wet):	13.308	180	0.040	94	383.0100	92	0.900	837.75	96.4	4.909	0.164	0.2000	
Wood moisture(%wet):	16.309	190	0.040	94	388.3000	93	0.900	837.75	96.3	4.909	0.163	0.2000	
Burn rate(dry kg/hr):	**0.947**	200	0.040	94	393.5780	93	0.900	837.00	96.0	4.898	0.162	0.2000	
Sample Volume (dscf)	**157.403**	210	0.040	93	398.8690	93	0.900	837.00	96.2	4.910	0.163	0.2000	
Avg. Tunnel Static (-inch H2O):	**0.1603**	220	0.040	93	404.1520	93	0.900	837.00	96.0	4.903	0.163	0.2000	
Room Blank Catch (mg/dscf):	0	230	0.040	93	409.4480	93	0.900	836.24	96.2	4.915	0.163	0.2000	
Emission Factor (g/kg):	**3.1625**	240	0.040	92	414.7340	93	0.900	836.24	96.0	4.906	0.164	0.2000	
Pitot Correction Factor:	0.97411	250	0.040	92	420.0260	93	0.900	836.24	96.1	4.911	0.163	0.2000	
front filter number	712	260	0.040	92	425.3050	93	0.900	836.24	95.9	4.899	0.162	0.2000	
back filter number	711	270	0.040	92	430.5960	93	0.900	836.24	96.1	4.910	0.163	0.2000	
Beaker Number:	24	280	0.040	92	435.8770	93	0.900	836.24	95.9	4.901	0.163	0.2000	
PRELIMINARY RESULTS		290	0.040	92	441.1670	93	0.900	836.24	96.1	4.909	0.163	0.2000	
FINAL RESULTS:	AUDITED	300	0.040	92	446.4600	93	0.900	835.48	96.1	4.912	0.164	0.2000	
DATA SUMMARY		310	0.040	91	451.7380	93	0.900	835.48	95.8	4.898	0.163	0.2000	
MODEL:	ASHWOOD	320	0.040	91	457.0270	93	0.900	763.38	87.7	4.908	0.164	0.2000	
RUN:	EPA 4	330			0.0000			0.00	0.0	0.000		0.0000	
DATE:	2\19\09	340			0.0000			0.00	0.0	0.000		0.0000	
DBR:	0.947	350			0.0000			0.00	0.0	0.000		0.0000	
EMISSION RATE (g/hr)(M5H)	4.5244	360			0.0000			0.00	0.0	0.000		0.0000	
EMISSION FACTOR (g/kg):	3.1625	370			0.0000			0.00	0.0	0.000		0.0000	
AVG. % PROPORTIONALITY :	96.592	380			0.0000			0.00	0.0	0.000		0.0000	

METHOD 5G **PARTICULATE SAMPLING DATA** Rev. 2/09

DATE: 2/19/09 PAGE 1 OF 2 UNIT: Kuma Ashwood RUN: EPA 4

METER BOX: 45G-P METER Y: 1.0177 FILTER #'S: (F) 712 (R) 711

.208/.2085

PRE TEST LEAK CHECK: .0005 CFM @ -15.5 IN HG FILTER SIZE: 110 mm

.079/.080

POST TEST LEAK CHECK: .001 CFM @ -15.0 IN HG PROBE LENGTH 21.0 IN

TIME		METER READING (FT^3)	PITOT		TUNNEL TEMP (°F)	METER TEMP (°F)	GAS METER Δh	VAC (in Hg)
CLOCK	ELAPSED		ΔP	Pg				
1240	00	288.413	.041	-.161	97	72	0.90	0.0
50	10	293.703	.039	-.157	106	75	.90	0
1300	20	298.951	.040	-.153	98	78	.90	0
10	30	304.180	.040	-.154	96	81	.90	0
20	40	309.389	.039	-.153	96	84	.90	0
30	50	314.609	.039	-.154	99	86	.90	0
40	60	319.817	.039	-.153	99	88	.90	0
50	70	325.048	.039	-.154	99	89	.90	0
1400	80	330.280	.040	-.154	99	90	.90	0
10	90	335.532	.039	-.157	98	90	.90	0
20	100	340.789	.041	-.161	98	91	.90	0
30	10	346.052	.041	-.162	96	92	.90	0
40	120	351.322	.041	-.163	96	92	.90	0
1450	30	356.601	.041	-.163	94	92	.90	0
1500	40	361.875	.042	-.163	93	92	.90	0
10	50	367.160	.041	-.162	93	92	.90	0
20	60	372.442	.041	-.163	93	92	.90	0
30	70	377.730	.040	-.163	94	92	.90	0
40	180	383.010	.040	-.164	94	92	.90	0
50	90	388.300	.040	-.163	94	93	.90	0

BP

00	28.55	300	28.50
60	28.54	320	28.495
120	28.53		
180	28.52		
240	28.51	AVG. =	28.521

Pre Test Filter Check Weighing

F .6892

R .6658

End of Test Weight

F .7420	R .6658
.6892	.6656
.532	.0002

METHOD 5G **PARTICULATE SAMPLING DATA** **Rev. 2/09**

DATE: 2/19/09 **PAGE** 2 **OF** 2 **UNIT:** Kuma Ashwood **RUN:** EPA 4

METER BOX: 45G-P **METER Y:** 1.0177 **FILTER #'S: (F)** 712 **(R)** 711

.209 / .12045

PRE TEST LEAK CHECK: .0005 **CFM @** -15.5 **IN HG** **FILTER SIZE:** 110 **mm**

POST TEST LEAK CHECK: .001 **CFM @** -15.0 **IN HG** **PROBE LENGTH** 21.0 **IN**

TIME		METER READING (FT^3)	PITOT		TUNNEL TEMP (°F)	METER TEMP (°F)	GAS METER Δh	VAC (in Hg)
CLOCK	ELAPSED		ΔP	Pg				
1600	200	393.578	.040	-.162	94	93	.90	0
10	10	398.869	.040	-.163	93	93	.90	0
20	20	404.152	.040	-.163	93	93	.90	0
30	30	409.448	.040	-.163	93	93	.90	0
40	240	414.734	.040	-.164	92	93	.90	0
50	50	420.026	.040	-.163	92	93	.90	0
1700	60	425.305	.040	-.162	92	93	.90	0
10	70	430.596	.040	-.163	92	93	.90	0
20	80	435.877	.040	-.163	92	93	.90	0
30	90	441.167	.040	-.163	92	93	.90	0
40	300	446.460	.040	-.164	92	93	.90	0
50	10	451.738	.040	-.163	91	93	.90	0
1800	20	457.027	.040	-.164	91	93	.90	0
	30							
	40							
	50							
	60							
	70							
	80							
	90							

BP

00	28.55	300	28.50
60	28.54	320	28.495
120	28.53		
180	28.52		
240	28.51		

AVG. = 28521

Pre Test Filter Check Weighing
F .16892
R .16658

End of Test Weight
F .16892
R .16656

MYREN CONSULTING, INC.
Dilution Tunnel Traverse Data with 8 Traverse Points

Unit: Kuma Ashwood
Run #: EPA 4
Date: 2/19 109
Technicians:
Rev 4/2/08

Point	Location	Δp	$\sqrt{\Delta p_{trav}}$	Δp	$\sqrt{\Delta p_{cent}}$	T_{trav}	T_{cent}	Pg
W-1	0.5"	.034	.1844			106		
2	1.5	.039	.1975			105		
Center	Center			.040	.2000		104	-.157
3	4.5	.040	.2000			102		
4	5.5	.036	.1949			102		
S-1	0.5	.036	.1897			101		
2	1.5	.040	.2000			100		
Center	Center			.040	.2000		100	-.160
3	4.5	.040	.2000			99		
4	5.5	.037	.1924			99		
	Totals		1.5589		.4000	814	204	-.317
	Average		.19486		.2000	101.75	102	-.1585
	°R = (°F + 460)				—	561.75	562	

Ps = BP + (-Pg/13.6) = 28.55 + (-.1585/13.6) = 28.538

LEAK CHECKS:
Pre Test: Pg Leg: ✓ ARP Velocity Head Leg: ✓ ARP
Post Test: Pg Leg: ✓ ATM Velocity Head Leg: ✓ ATM

DILUTION TUNNEL GAS VELOCITY & VOLUMETRIC FLOW RATE CALCULATIONS Rev 4/19/08

UNIT: Kuma Ashwood DATE: 2/19/09 RUN #: EPA 4 TECHNICIAN(S): ATM JRP PDF

Average Gas Velocity in the Dilution Tunnel Vstrav (EPA M2 EQN 2-9, ASTM E 2515-07 EQN 7)

(9) Vstrav = (85.49) (0.99 cp) (.19486 x $\sqrt{\Delta P}$ "H_2O) $\sqrt{\dfrac{561.75 \text{ Ts °A } \{0\}}{(28.538 \text{ Ps "Hg}) \{2\} (28.56 \text{ lb./ lb. mole})}}$ = 13.69159 fps
{2} {2} {2}

(9A) Vs = (13.69195 fps) (60) = 821.495 fpm
{2} {2}

Gas Velocity in the Center of the Dilution Tunnel - Vscent (EPA M2 EQN 2-9, ASTM E 2515-07 EQN 7)

(9) Vscent = (85.49) (0.99 cp) (.2000 x $\sqrt{\Delta P}$ "H_2O) $\sqrt{\dfrac{562 \text{ Ts °A } \{0\}}{(28.528 \text{ Ps "Hg}) \{2\} (28.56 \text{ lb./ lb. mole})}}$ = 14.05587 fps
{2} {2} {2}

(9A) Vs = (14.05587 fps) (60) = 843.352 fpm
{2} {2}

EPA M5G1 Section 4.2.2, ASTM E 2515-07 EQN 1 Adjustment Factor for Center of Tunnel Pitot Tube Location

Fp = Vstrav/ Vscent = 13.69195 ÷ 14.05587 = 0.97411

Average Stack Gas Dry Volumetric Flow Rate - Qsd (EPA M2 EQN 2-10, ASTM E 2515-07 EQN 3)

(10) Qsd = 3600 (1 - 0.04 Bws) (13.69159 fps) {2} (.1963 ft^2) {3} [(528 °A) (28.538 Ps "Hg) {2} / (561.75 T_s °A) {0} (29.92" Hg) =
8327.233 dscfhr (or dscfh)
{1}

(10A) 8327.233 dscfhr ÷ 60 = 138.787 dscfmin (or dscfm)
{1} {1}

Note: Number in { } under blank lines denotes number of decimals to be used. If a blank calls for an answer already calculated, use the number of decimals previously specified for that answer.

WST5-Form9,Pg2,Rev1/90

WOODSTOVE DATA SHEET #4-1: INITIAL FILTER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date 1-20-09 Time 1149 By PDG Front Half X Back Half X

Manufacturer: Pall P/N 60115 Size: 110 Lot.No.: 70726 Grade: A/E Glass

Filter #	First Wt	2009 Date	Time	By	Second Wt	Date	Time	By	Third Wt	2009 Date	Time	By
700	.6873	1-22	1331	GRP	.6877	1-23	1417	PDG				
701	.6871		1330	GRP	.6878		1419	PDG	.6877	1.26	1421	GRP
702	.6816		1329	GRP	.6825		1420	PDG	.6824	1.26	1920	GRP
703	.6761		1328	GRP	.6762		1421	PDG				
704	.6727		1327	GRP	.6732		1422	PDG				
705	.6833		1326	GRP	.6837		1423	PDG				
706	.6946		1325	GRP	.6948		1424	PDG				
707	.6773		1324	GRP	.6777		1425	PDG				
708	.6701		1323	GRP	.6702		1426	PDG				
709	.6799		1322	GRP	.6809		1427	PDG	.6806	1.26	1419	GRP
710	.6587		1321	GRP	.6590		1428	PDG				
711	.6654		1320	GRP	.6656		1429	PDG				
712	.6688		1319	GRP	.6892		1430	PDG				
713	.6864		1318	GRP	.6866		1431	PDG				
714	.6651		1318	GRP	.6655		1432	PDG				
715	.6741		1317	GRP	.6744		1433	PDG				
716	.6592		1316	GRP	.6590		1434	PDG				
717	.6531		1315	GRP	.6536		1435	PDG				
718	.6621		1314	GRP	.6623		1436	PDG				
719	.6769		1313	GRP	.6769		1437	PDG				
720	.6627		1312	GRP	.6628		1438	PDG				
721	.6567		1311	GRP	.6569		1439	PDG				
722	.6539		1310	GRP	.65340		1440	PDG				
723	.6552		1309	GRP	.6552		1441	PDG				
724	.6655		1308	GRP	.6656		1442	PDG				

Checked by A.T. Myers Date: 1/27/09 Time 1632

QA REWEIGH

Filter #	WT	Date	Time	By
703	.6761	1/27/09	1639	ATM
708	.6703	"	1640	ATM
715	.6749	✓	1642	ATM

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
57	72	38	1-22-09	1138	ATM
58	75	33	1-23-09	1150	PDG
56	74	25	1-26-09	1359	GRP
58	72	31	1/27/09	1530	PDG

Post	1-22	1-23	1-26
0.0000	0.0000	0.0000	0.0000
100.0000	99.9994	99.9993	99.9993

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Blank done 12/3/07

Into Dessicator: Date: 10/12/07 Time: 0801 By: GRP

Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
22	71.8343	10/22/07	1358	GRP	71.8332	11/10/07	1938		71.8330	11-11-07	1748	Jm
24	73.2192		1400	GRP	73.2190	11/10/07	1940		73.2193	11-11-07	1746	Jm
25	72.6516		1401	GRP	72.6512	11/10/07	1944	←	Blank			
26	71.7895		1403	GRP	71.7888	11/10/07	1939		71.7886	11-11-07	1747	Jm
27	72.3316		1402	GRP	72.3314	11/10/07	1945					
28	70.5979		1404	GRP	70.5975	11/10/07	1941		70.5977	11-11-07	1745	Jm
39	53.1508		1405	GRP	53.1500	11/10/07	1942					
37	53.7237	11/10/07	1945	ATM	53.7238	11/11/07	1743	Jm				

Checked By: ______________ Date: ______________ Time: ______________

QA REWEIGH

Beaker #	WT	Date	Time	By
27	72.3315	11-11	1740	Jm
25	72.6515	11-11	1741	Jm
39	53.1509	11-11	1744	Jm

Post weighing 1st 2nd
0.0000g 0.0000

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
57	68	50	10/22/07	1344	GRP
			11/10		

WST5-Form9 Rev4/90
Unit Kuma Ashwood
Run # EPA 4
Date: 2/19/2009

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

45 ml

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
24	73.2246	2/21	1540	ATM	73.2253	2/22	1236	JM	73.2242	2/23	1411	PDG	73.2238	2/24	1005	ATM

FINAL FILTER WEIGHTS

	Filter #	Into Dessic	Date	Time	By	First	2009 Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
F	712	.7420	2/19	1830	ATM	.7416	2/20	1033	PDG	.7409	2/21	1546	ATM	.7410	2/22	1242	JM
						Fourth .7415	2/23	1422	PDG	.7410	2/24	1014	ATM				
R	711	.6658	2/19	1830	ATM	.6655	2/20	1039	PDG	.6653	2/21	1841	ATM				

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By
Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	2009 Date	Time	By	WB	DB	%RH
1	2/20	1018	PDG	57	74	33
2	2/21	1519	ATM	60	77	35
3	2/22	1222	ATM	47	59	37
4	2/23	1406	PDG	58	70	48
5	2/24	0953	ATM	59	76	35

SCALE ROOM ENVIRONMENTAL CONDITIONS

6						
7						
8						
9						

Comments

Acetone
Lot #
041648

Tare 72.6512

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

Blank done 12/18/07

WST5-Form9, Pg1, Rev4/90
Unit Kuma Ashwood
Run # EPA 4
Date: 2/19/09

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	2007 Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
25	✓	12/12	1546	JRP	72.6508	12/13	1342	JRP	72.6511	12/14	1347	[illegible]				

FINAL FILTER WEIGHTS

Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By

Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	2007 Date	Time	By	WB	DB	%RH
1	12/13	1307	JRP	55	73	29
2	12/14	1321	JRP	57	75	31
3						
4						

SCALE ROOM ENVIRONMENTAL CONDITIONS

6						
7						
8						
9						

Comments

WOODSTOVE DATA SHEET 4-4 SCALE QC RECORD SHEET

FROM: 9/27/2007
THROUGH: 12/7/2007

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

Level	Recalibrated	130 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	129.9998	99.9998	10.0000	1.0000	0.1000	0.0199	9/27/07	1402	GRP	55	67	45
✓	Y	129.9995	99.9996	10.0001	1.0000	0.1000	0.0200	9/28/07	1335	GRP	57	69	46 ATM
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0200	10/1/07	1505	ATM	58	70	48
✓	N	129.9995	99.9996	10.0000	1.0001	0.1000	0.0199	10/2/07	1611	GRP	56	68	46
✓	N	129.9997	99.9997	9.9999	1.0001	0.1000	0.0199	10/3/07	1122	GRP	56	68	46
✓	N	129.9996	99.9996	10.0000	1.0000	0.0999	0.0199	10/4/07	1025	GRP	55	67	45
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	10/5/07	0750	GRP	51	62	45
✓	N	129.9997	99.9997	9.9999	1.0000	0.1000	0.0199	10/5/07	1513	GRP	56	69	43
✓	Y	129.9996	99.9996	10.0000	1.0001	0.1001	0.0200	10/9/07	1505	ATM	58	71	44
✓	N	129.9996	99.9997	10.0000	1.0001	0.1001	0.0200	10/12/07	1259	ATM	58	70	48
✓	Y	129.9995	99.9996	9.9999	1.0000	0.1000	0.0199	10/22/07	1344	GRP	57	68	50
✓	Y	129.9996	99.9997	9.9999	1.0000	0.1000	0.0199	10/29/07	1338	GRP	53	63	50
✓	N	129.9995	99.9995	10.0000	1.0000	0.1000	0.0200	10/30/07	0933	ATM	56	70	40
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1000	0.0199	10/30/07	1457	GRP	55	70	36
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	10/31/07	1528	GRP	57	75	30
✓	Y	129.9996	99.9996	9.9999	1.0000	0.0999	0.0199	11/2/07	1238	GRP	52	67	33
✓	Y	129.9996	99.9996	10.0000	1.0001	0.1000	0.0199	11/5/07	0730	GRP	57	73	35
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1001	0.0201	11/9/07	1550	ATM	58	70	48
✓	N	129.9996	99.9997	10.0000	1.0000	0.1000	0.0200	11/10/07	1835	ATM	58	71	44
✓	Y	129.9997	99.9997	9.9999	1.0000	0.1000	0.0199	11/11/07	1810	ATM	55	69	39
✓	N	129.9997	99.9996	9.9999	1.0000	0.1000	0.0199	11/12/07	0822	GRP	54	67	41
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	11/13/07	1226	ATM	58	72	41
✓	N	129.9998	99.9997	9.9999	0.9999	0.1000	0.0200	11/14/07	1710	GRP	58	73	39
✓		QC Services Audit 11/14/07											
✓	Y	129.9997	99.9997	10.0000	1.0000	0.1000	0.0200	11/15/07	1358	ATM	59	72	45
✓	N	129.9996	99.9996	9.9999	0.9999	0.1000	0.0200	11/16/07	1600	GRP	58	71	44
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	11/17/07	1758	ATM	60	74	43
✓	Y	129.9997	99.9997	10.0000	1.0001	0.1001	0.0200	11/19/07	1143	ATM	56	70	40
✓	Y	129.9995	99.9996	10.0000	1.0000	0.1000	0.0199	11/20/07	1416	GRP	54	69	35
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	11/21/07	1110	ATM	57	70	44
✓	N	129.9995	99.9996	10.0000	1.0000	0.1000	0.0199	12/3/07	0730	GRP	55	69	40
✓	N	129.9996	99.9996	10.0000	1.0000	0.0999	0.0200	12/6/07	1125	ATM	54	67	44
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/7/07	1348	GRP	55	69	40

WOODSTOVE DATA SHEET 4-4 SCALE QC RECORD SHEET

FROM: 12/8/07
THROUGH: 2/3/08

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

Level	Recalibrated	130 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/8	1215	ATM	57	73	35
✓	N	129.9996	99.9996	10.0000	1.0000	0.1001	0.0200	12/8	1910	ATM	57	72	38
✓	N	129.9997	99.9996	10.0000	1.0000	0.1000	0.0199	12/9	1935	ATM	55	72	31
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/10	1953	ATM	56	72	34
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/11	1618	GRP	57	76	28
✓	N	129.9997	99.9996	10.0000	1.0000	0.0999	0.0199	12/12	1505	GRP/[illegible]	56	74	30
✓	N	129.9996	99.9996	9.9999	0.9999	0.1000	0.0199	12/13	1307	GRP	55	73	29
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	12/14	1321	GRP	57	75	31
✓	N	129.9998	99.9998	9.9999	1.0001	0.1000	0.0199	12/15	1602	GRP	57	75	31
✓	Y	129.9996	99.9997	9.9999	1.0000	0.1000	0.0199	12/17	0817	GRP	55	73	29
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/18	0853	GRP	58	75	34
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/19	0812	GRP	55	72	31
✓	Y	129.9995	99.9996	10.0000	1.0001	0.0999	0.0199	12/20	0916	GRP	57	71	41
✓	Y	129.9998	99.9997	10.0000	1.0000	0.1000	0.0199	12/21	1085	ATM	55	70	36
✓	N	129.9997	99.9996	10.0000	1.0000	0.10000	0.0200	12/22	1434	[illegible]	54	66	44
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/23	0915	ATM	57	70	44
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	12/26	1330	ATM	57	70	44
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0200	12/27	1030	ATM	56	72	34
✓	N	129.9998	99.9997	9.9999	1.0000	0.1000	0.0200	1/8/08	1342	GRP	54	68	38
✓	N	129.9997	99.9997	10.0000	1.0001	0.1000	0.0200	1/9/08	0742	GRP	55	70	36
✓	N	129.9998	99.9998	10.0000	1.0000	0.1000	0.0199	1/11/08	1040	ATM	59	73	42
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1000	0.0199	1/16/08	1221	GRP	51	72	18
✓	N	129.9999	99.9998	10.0000	1.0000	0.1000	0.0199	1/17/08	1237	GRP	56	71	37
✓	N	129.9998	99.9998	10.0000	1.0000	0.0999	0.0200	1/18/08	1116	GRP	56	71	37
✓	Y	129.9995	99.9996	9.9999	1.0001	0.1000	0.0199	1/21/08	1426	GRP	56	72	34
✓	N	129.9995	99.9996	10.0000	1.0001	0.1000	0.0199	1/22/08	1513	GRP	56	71	37
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	1/23/08	0805	GRP	54	69	36
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	1/24/08	0758	GRP	54	70	33
✓	N	129.9998	99.9997	10.0000	1.0000	0.1000	0.0199	1/24/08	1450	GRP	56	71	37
✓	N	129.9997	99.9996	10.0000	1.0000	0.1000	0.0200	1/31/08	1505	GRP	55	69	38
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	2/1/08	1029	GRP	54	69	36
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	2/2/08	1620	ATM	58	72	41
✓	N	129.9996	99.9997	10.0000	1.0001	0.1000	0.0200	2/3/08	1710	ATM	57	70	44

WOODSTOVE DATA SHEET 4-4 ANALYTICAL BALANCE QC RECORD SHEET

FROM: 12/20/08
THROUGH: 2/17/09

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

Level	Recalibrated	140 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	12/20/08	1430	ATM	58	72	42
✓	N	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	12/23/08	1057	JRP	60	76	38
✓	N	139.9994	99.9994	9.9999	1.0001	0.1000	0.0200	12/24/08	1019	ATM	59	72	45
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0200	12/26/08	1142	ATM	59	72	45
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0200	12/28/08	1050	ATM	60	75	37
✓	N	139.9994	99.9994	10.0000	.9999	0.1000	0.0199	1/05/09	1157	PDG	58	75	34
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	1/6/09	1845	ATM	60	75	37
✓	N	139.9995	99.9996	9.9999	1.0000	0.1000	0.0199	1/7/09	1530	JRP	58	70	48
✓	N	139.9994	99.9994	9.9999	.9999	0.1000	0.0199	1/8/09	1356	PDG	60	72	49
✓	Yes	139.9993	99.9994	9.9999	1.0000	0.1000	0.0200	1/09/09	1053	PDG	58	72	42
✓	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	1/11/09	1128	JRP	55	72	31
✓	YES	139.9994	99.9995	9.9999	1.0000	0.1000	0.0199	1/12/09	0845	PDG	59	75	38
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0200	1/13/09	0825	JRP	58	74	37
✓	Yes	139.9993	99.9994	9.9999	0.9999	0.1000	0.0199	1-14-09	1212	PDG	57	72	38
✓	NO	139.9993	99.9993	9.9999	1.0000	0.0999	0.0199	1/14/09	1420	JRP	59	75	37
✓	NO	139.9992	99.9993	10.0000	1.0000	0.0999	0.0199	1-15-09	1128	JRP	58	74	37
✓	Yes	139.9994	99.9995	9.9999	0.9999	0.1000	0.0199	1-20-09	0950	PDG	58	74	37
✓	no	139.9993	99.9994	10.0000	0.9999	0.1000	0.0199	1-20-09	1230	PDG	56	71	37
✓	NO	139.9993	99.9993	9.9999	1.0000	0.0999	0.0199	1-20-09	1613	JRP	57	73	35
✓	No	139.9994	99.9994	9.9999	1.0000	0.1001	0.0200	1/22/09	1138	ATM	57	72	38
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	1/23/09	1150	PDG	58	75	33
✓	YES	139.9992	99.9993	10.0000	1.0000	0.0999	0.0200	1/26/09	1359	JRP	56	76	25
✓	no	139.9994	99.9995	10.0000	1.0000	0.1000	0.0199	1/27/09	1530	PDG	55	72	31
✓	No	139.9993	99.9993	10.0000	1.0001	0.1001	0.0200	1/28/09	1452	ATM	61	75	41
✓	YES	139.9993	99.9994	10.0000	1.0000	0.1000	0.0199	1-29-09	1436	JRP	58	77	29
✓	no	139.9995	99.9995	9.9999	0.9999	0.1000	0.0199	1/30/09	1256	PDG	60	72	49
✓	Yes	139.9993	99.9994	9.9999	1.0000	0.1000	0.0199	2/1/09	1260	ATM	58	74	37
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	2/2/09	1350	JRP	58	77	29
✓	Yes	139.9995	99.9996	9.9999	1.0000	0.1000	0.0199	2/5/09	1118	PDG	59	72	45
✓	NO	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	2/6/09	1150	JRP	57	74	33
✓	No	139.9994	99.9994	10.0000	1.0001	0.1000	0.0200	2/9/09	1015	ATM	49	70	19
✓	NO	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	2/16/09	1551	PDG	61	78	36
✓	NO	139.9993	99.9994	9.9999	1.0000	0.1000	0.0200	2/17/09	1439	JRP	56	72	35

WOODSTOVE DATA SHEET 4-4 ANALYTICAL BALANCE QC RECORD SHEET

FROM: 2/10/09

THROUGH:

SCALE: SARTORIUS

MODEL: CP224S

SN: 17050374

Level	Recalibrated	140 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
Y	Y	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	2/10/09	1800	ATM	55	70	36
Y	Y	139.9993	99.9994	9.9999	1.0000	0.1000	0.0199	2-19-09	1248	JRP	56	73	32
Yes	Y	139.9993	99.9994	9.9999	0.9999	0.1000	0.0199	2/20/09	1018	PDG	57	74	33
Yes	Y	139.9993	99.9994	10.0000	1.0000	0.1000	0.0200	2/21/09	1519	ATM	60	77	35
Yes	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	2/22/09	1223	ATM	47	59	37
~~Y~~	~~Yes~~	~~139.9994~~	~~99.9994~~	~~9.9999~~	~~0.9999~~	~~0.1000~~	~~0.0199~~	~~2/23/09~~	~~1406~~	~~PDG~~	~~58~~	~~70~~	~~48~~
Yes	No	139.9994	99.9994	9.9999	1.0000	0.1000	0.0200	2/24/09	0953	ATM	59	76	35
Yes	Yes	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	2/25/09	1123	PDG	60	76	38
Yes	Yes	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	2-26-09	1258	JRP	55	70	36
YES	YES	139.9993	99.9993	9.9999	1.0001	0.1001	0.0200	2/28/09	1330	ATM	57	74	33
Yes	Yes	139.9995	99.9995	9.9999	0.9999	0.1000	0.0199	3/3/09	1431	PDG	59	76	35
~~Yes~~	~~NO~~	~~139.9993~~	~~99.9995~~	~~9.9999~~	~~1.0000~~	~~0.1000~~	~~0.0199~~	~~3/4/09~~	~~1556~~	~~JRP~~	~~56~~	~~70~~	~~40~~
Yes	No	139.9994	99.9994	9.9999	1.0001	0.1001	0.0200	3/5/09	1350	ATM	60	75	40
Yes	No	139.9993	99.9993	9.9999	1.0000	0.1000	0.0200	3/7/09	0850	ATM	57	71	41
Yes	Yes	139.9993	99.9993	10.0000	1.0000	0.1000	0.0200	3/8/09	1323	ATM	55	70	36
Yes	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	3/10/09	1212	PDG	50	75	10

Woodstove Particulate
Catch Processing Sheet
Woodstove Data Sheet #5
EPA M5G-1

Unit : Kuma Ashwood
Run: EPA 4
Date: 2/19/09
Technicians: A,T,M
Revised 1/16/98-Data Sheet #5

Filters

Filter # (Front) 712 Beaker # 24 Final Wt. 73.2238 g
Final Wt. .7410 g Ml 45 Tare Wt. 73.2188 g
Tare Wt. .6892 g Desc. Acetone Net Wt. .0050 g
Net Wt. .0518 g

Filter # (Rear) 711 Beaker # ______ Final Wt. ______ g
Final Wt. .6653 g Ml ______ Tare Wt. ______ g
Tare Wt. .6656 g Desc. ______ Net Wt. ______ g
Net Wt. -.0003 g

Acetone Blank Calculation: Blank Date: 12/18/07

Blank Beaker # 25 Final Wt. 72.6511 g
Ml 50 Tare Wt. 72.6512 g
Desc. Acetone Net Wt. -0.0001 g = 0.0000
0.0000 g ÷ 50 ml = 0.00000 g/ml

Blank Residue Value Calculation:

0.00000 g/ml acetone X 45 ml acetone = 0.0000 g
Blank Residue Value

Total Particulate Catch Calculation

Filter: .0518 g
Filter: -.0003 g
Beakers: .0050 g (Total Catch) -- 0.0000 g (Blank Residue Value) = .0050 g

Total Catch = .0565 g

Unit Kuma Ashwood
Run # EPA 4
Date 2/19/09
Technician ATM JRP PDG
WST6-Form1,Rev8/96

MISCELLANEOUS TEST DATA
WOODSTOVE DATA SHEET #8

Useable Firebox Dimensions: See QC Section Useable Volume: 2.094 ft^3

Dilution Tunnel Draft (If applicable): Start .000 Stop .000 "H_2O

Test Chamber Air Velocity: Start: 00.0 Stop: 00.0 Avg: 00.0 ft/MIN

Wet Bulb/ Start: WB: 57 °F DB: 73 °F 1.0 % Amb Moisture 35 %RH
Dry Bulb Stop: WB: 60 °F DB: 72 °F 1.35 % Amb Moisture 49 %RH
$\bar{x}$ = 1.175 % Ambient Moisture $\bar{x}$ = 42.0 % Relative Humidity (RH)

Empty Stove Wt: 440.2 lbs.

Empty Stove Wt with Stack (Inc. Oil Seal) Wet: 763.8 lbs. Dry: 763.8 lbs.

Empty Stove Wt with Stack and Ash Ash: — lbs. Total: — lbs.

Kindling Wt. Total 4.8 lbs. Paper: 0.4 lbs. Wood: 4.4 lbs.

Pre Burn Fuel Wt. 11.434 + 13.786 + 10.638 Total: 35.858 lbs.

Total Kindling and Pre Burn Fuel Wt 40.658 lbs.

Coal Bed Wt-lbs: Range (3.3 - 2.7) 767.1 - 766.5 lbs. Actual: 3.3 767.1 lbs.

Allowable Amount of Charcoal that can be removed:

Coal Bed Wt. Range (3.3 Upper Wt. + 2.7 Lower Wt. /2) X .25 = 0.7 lbs.

Test Fuel Wt-lbs: Ideal 14.7 lbs. Range: 16.1 - 13.2 lbs. Actual: 13.308 lbs.

Test Fuel Size (pcs.) (.75 x 1.5 x 5" Flanges) lbs 16 Pcs.

2 x 4's x 16.375 " 3 Pcs 7.088 lbs. 53.27 %

4 x 4's x 16.375 " 2 Pcs 6.218 lbs. 46.73 %

5.0512 kg

Est. Dry Burn Rate (Kg/Hr.) $\frac{13.308 - (13.308 \times .16309)}{2.2046} \times \frac{60}{320}$ = 0.9471 Est. Dry Burn Rate (Kg/Hr)

Est EPA Heat Output (HO_E) (Avg BTU's/Hr) (19,140) X $\frac{63}{100}$ x .9471 = 11,420 Est Heat Output (HO_E) BTU's/Hr

Comments: 305 mins = 0.9937 kg/hr.

Stove Operating Data
Woodstove Test Data Sheet #9
Cold Start

Unit: Kuma Ashwood
Run: EPA 4
Date: 2/19/09
Technician(s): AJ Myren
Data Sheet#9–Rev 1/98-Pg.2

Fire Started: 0:8:46

Warm up and Preburn: Primary Air: Wide open from ignition until the start of preburn when the primary air control(s) was (were) adjusted to the run setting of .3655" PAC. At the run setting until the start of the test. 2.3735" Threaded rod

Secondary Air: No Controls, Naturally drafted

Secondary Burn Bypass: N/A

Charcoal Bed Preparation: Broke up, raked and leveled the coal bed prior to the addition of each warm up/pre burn fuel charge. Starting 1:30 before the start of the test, broke up, raked and leveled the coal bed. In stove for 32 seconds.

Test: Door wide open during loading 1 min 15 sec, then closed.

Primary Air: Wide open from the start of the test (0:00) until 4:45. Adjusted to the run setting of .3655" between 4:45 and 5:00. At the run setting of 0.3655" open at 5:00 into the run.

Secondary Air: No Controls, Naturally drafted.

Secondary Burn Bypass: N/A

Fan: ON/OFF during the warm up, ON/OFF Low during the preburn, ON/OFF at the start of test, ON/OFF for the first 30 minutes of test, ON/OFF Low at 30 minutes into test, ON/OFF for the rest of test.

Test Run Anomalies:

Unit Kuma Ashward
Run # EPA 4
Date 2/ 19 109
Technician ATM
Page 1 of 5
WST7-Form2-A, Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-1

Wood Data: Kindling: A mix of the below grades

	Size	Mill	Grade	Species
Pre Burn	2X4	Forest Grove	#2, Std & Btr	D. Fir, Sfc Grn
Test Fuel	2X4	Forest Grove	#2, Std & Btr	D. Fir, Sfc, Grn
	4X4	Forest Grove	No. 1	D. Fir, Sfc, Grn

All grades WCLB Rules unless otherwise noted.

Warm up Information:

1st Warm up/Pre Burn Fuel charge (11.434 lbs) added at 0906.
2nd Warm up/Pre Burn Fuel charge (13.786 lbs) added at 1006.
3rd Warm up/Pre Burn Fuel charge (10.638 lbs) added at 1117.
4th Warm up/Pre Burn Fuel charge (________lbs) added at ________.
5th Warm up/Pre Burn Fuel charge (________lbs) added at ________.
6th Warm up/Pre Burn Fuel charge (________lbs) added at ________.
7th Warm up/Pre Burn Fuel charge (________lbs) added at ________.
8th Warm up/Pre Burn Fuel charge (________lbs) added at ________.

1st Rick 4-12", 4-16" 2X4's   3rd Rick 4-12", 3-16" 2X4's
2nd Rick 8-16" 2X4's

The coals were scooped out of the stove immediately prior to adding the 3rd pre burn/warm up fuel charge. The stove lost 0 lbs. 2.0 lbs. of coals were put back in the stove after the scoop.

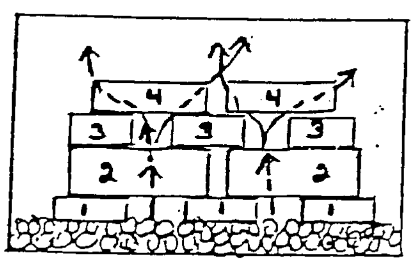
All pre burn/warm up fuel pieces were either 12 or 16 inches long. All preburn pieces/fuel charges were "ricked" in the stove. The pieces in the bottom layer in each rick contained 2 pcs that were 12 or 16 inches long and were loaded flat and perpendicular to the door. The pieces in the second layer in each rick were loaded on their side (edge) approximately parallel to the door and contained 3 or 4 pcs 16 inches long. The third layer (and fourth layer if present) was loaded flat, perpendicular to the door and contained 2 pcs 12 or 16 inches long. The majority of the pieces in each rick were in the second layer which had an approximate 0.5-1.0" space between pieces. (The loading directions indicate the direction of the longest dimension on each piece relative to the loading door opening.) Each pre burn/warm up fuel charge normally weighs within the weight range allowed for the actual test fuel charge

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-2

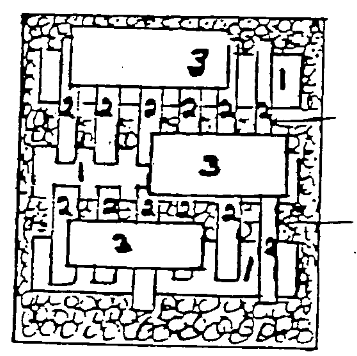
Warm up Information (cont.):

Each warm up/preburn fuel charge was ricked in exactly (as much as possible) the same manner and the weight of each rick was usually within the allowable weight range for the test fuel charge. The physical arrangement and alignment of each rick was designed to accomplish three (3) things: (1)The bottom layer was nestled firmly into the coal bed and was as close to being level with the bottom of the stove as possible, thus providing a stable loading platform for the rest of the rick, keeping it in a ricked state (as opposed to a col- lapsed or fallen down state) untill the rick reached the charcoal stage and sags or collapses of its own accord. (2) It enhances the flow of primary air through the ricked preburn fuel charge, for the primary air would flow through the spaces between the pieces in the first layer and then up through the spaces between the pieces in the second, third and, if present, fourth layers. (3) It maximized, as much as possible, the surface to volume ratio of each preburn fuel charge, thereby allowing the fire immediate access to as much wood surface as possible and, thereby, insuring uniform charcoalization. All three of these enhance combustion and so get the stove as hot as possible during the warm up period, therby maximizing the amount of heat (BTU's) stored in the stove. The actual preburn was not started until the stove surface temperatures had maximized and stabilized, thus indicating that the amount of heat stored in the stove had peaked. For this stove, the thermal storage was monitored using the Stove Top T/C surface temperature(s) and the peak value(s) obtained were 1044 °F.

758
998
1044



Front View



Top View

The arrows indicate the direction of the air flow through the rick.

The primary air was adjusted to the run setting of 0.3655" open 3.5 lbs above the upper charcoal bed weight.

Unit Kuma Ashwood
Run # EPA 4
Date 2/ 19 /09
Technician AJM
Page 3 of 5
WST5-Form2-Rev11/89

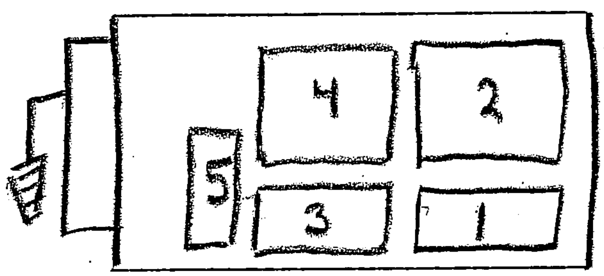
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-3

Additional Comments: Test Start Sequence: ① Turned Fan off ② Adjusted PAC to wide Open ③ opened door ④ loaded fuel ⑤ cleared coals away from in front of the LPAO ⑥ closed door

TOTAL ElApsED Time: 1:15
Photo @ 1:40

Test Fuel Charge Loading Information:

Test Fuel Charge and Loading Sequence Diagram



SIDE of stove view

4 X 4's: 2, 4

2 X 4's: 1, 3 & 5

Loading Sequence: 1, 2, 3, 4 & 5 last

Driest Pcs in Load 5, 3, 4

Loaded the test fuel charge on an essentially level, medium sized, average coal bed (in appearance, color and temperature for a Low (≤1.0kg/hr burn rate. Load: 1:15 Ignition: 1:16

1:17 VC to the baffle
1:30 Secondaries starting to ignite
1:40 Photo
<3:30 Secondaries full width of pcs 4&5
4:45-5:00 Adjusted PAC to burn setting
5:00 Flames decreased, Maintained a hot pocket of coals under pc 5 with a VC up to baffle with secondaries at the top of the VC. Both VC and Secondaries decreasing fairly quickly.
5:30 11.9 / .49 (%CO2 / %CO)
6:21 Secondaries on/off above pc 4
6:47 VC increasing in height and width

Unit Kenmore Ashwood
Run # EPA 4
Date 1/19/09
Technician ATH
Page 4 of 5
WST5-Form2-Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-4

Additional Comments:

8:40 just secondary flashes at the top of the VC
10:07 Secondaries, VC decreasing
10:29 5.9/.94 M smoke Lots of velocity in VC. Just V flickers to the baffle. No Secondaries.
14:49 VC flickers to baffle.
15:28 5.5/1.11 MH
16:03 center part of VC out briefly 2 times
Drop in fire
16:20 Left side of VC increasing
17:07 Secondary flash above center/top of 4
18:00 VC decreasing again
18:25 Secondary flashes increasing
20:46 5.9/1.27 MH
21:50 Flames on bottom edge of pc 5 left of center.
24:53 VC spreading to Left of center. Secondary flashes staying lit longer
25:26 6.4/1.33 MH/H
26:11 Left side of VC increased, then decreased
26:43 Secondaries burst on, then quickly off
27:40 " almost steady
30:00 Fan O - Low. Steady Secondaries
30:43 8.0/1.53 M/MH
31:39 VC decreasing. Top down burn. Cold blue orange 2nds.
32:14 Secondaries forward past front tube.
33:11 Secondaries barely full width of 4
33:48 yellow flames center front of pc5 M Smoke straight into stack tips

Unit Kenm Ashwood
Run # EPA 3
Date 3/18/09
Technician ATH
Page 5 of 5
WST5-Form2-Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-4

Additional Comments:

34:49 12.35 / 1.55
36:08 14.52 / 1.63
36:49 15.10 / 1.50 Gas Balance m/mH still stackitis
37:47 Out of balance - Velocity in Secondaries
40:20 15.6 / 1.34 back in balance
45:41 Pc 5 has cracked thru.

Unit: Kuma Ashwood
Run: EPA 4
Date: 2/19/09
Technician: AHM JRP PDG
WST1-Form7-Rev11/89

FUEL MOISTURE
WOODSTOVE TEST DATA SHEET #10

5 kg. = 11.024 lbs   1 kg. = 2.204 lbs

Room Temperature: 64.8 °F   Correction Factor: +0.5

NOTE: Record readings to the nearest 0.5% moisture
Uncor Values are corrected for temperature: Yes ✓ No ____
Time Test Fuel Moisture Readings taken at: ____
Calibration Checks: X ---- Y ---- 12.0 11.75 22.0 22.0

	Pc #	Dimen	Use	Top Uncor	Top Cor	Bottom Uncor	Bottom Cor	Side Uncor	Side Cor	Piece Avg Corrected
	1	3pcs	K	10.75	11.45	8.5	8.95	7.5	7.85	9.417
	2									
	3									
	4	2x4-8'	P	19.5	20.9	18.0	19.2	18	19.2	19.767
	5			21	22.6	22	23.7	18	19.2	21.833
	6			18.5	19.8	18.5	19.8	19.5	20.9	20.167
	7			19	20.3	19.5	20.9	22	23.7	21.633
	8			19.5	20.9	21.5	23.1	22	23.7	22.567
	9									105.967
	10									
8	11	2x4-16 3/8"	T	18	19.2	18	19.2	18	19.2	19.200
2.112	12			18.5	19.8	18.5	19.8	19	20.3	19.967
1.594	13			18.5	19.8	18.5	19.8	18	19.2	19.600
	14									
3.514	15	4x4-16 3/8"	T	20	21.4	21.5	23.1	13	13.9	19.467
3.224	16			18	19.2	18	19.2	18	19.2	19.200
	17									97.434
	18									
1.450	19	Spacers	T	19	20.3	19	20.3	18.5	19.8	20.133
	20								OUT	Spacers

	Kindling	Pretest Fuel	Test Load
% Moisture - Dry Basis:	9.417 %	21.1934 %	19.4868 %
% Moisture - Wet Basis:	8.606 %	17.487 %	16.309 %

13.306 4x4 7.088

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

1, 11.434
2, 13.786
3, 10.638

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

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

Unit: Kuma Ash wood
Run#: EPA 4
Date: 2/19/09
Technician: A.T Myren

WOOD DENSITY DETERMINATION
WOODSTOVE TEST DATA SHEET #11

WST2-form11-Rev 6/90

2X4

Wood Piece: Nominal Dimensions: 3.5 x 3.5 x 1.5

Depth (D): 3.830 cm

Width (W): 8.825 cm

Length (L): 9.265 cm, 9.250 cm, 9.315 cm, 9.290 cm

Length $\bar{X}$ = 9.280 cm

Volume: 313.662 cm^3 (D X W X L)

MOISTURE: Room Temperature: 64.8 °F Correction Factor: +0.5

Uncorrected Meter Readings Corrected for temperature: Yes ✓ No ___

NOTE: Record moisture meter readings to the nearest 0.5%

	Uncor	Cor
Top:	18.5	19.8 %
Bottom:	18.5	19.8 %
Side:	17.5	18.6 %
$\bar{X}$:		19.400 %

Avg % Moisture (Dry) 19.400 %

Avg % Moisture (Wet) 16.248 %

Scale: Leveled In ___ Out ___

Zeroed: In ___ Out ___

Wet Weight: 137.9 g Dry Weight: 115.6 g

% Moisture Dried Basis: 16.171 %
[1 - (Dry Wt ÷ Wet Wt)] X 100

	Date	Time	Temp
Into Dryer	2/19/09	1337	190 °F
Out of Dryer	3/2/09	0915	192 °F

(Minimum Time in Dryer: 24 hrs.) Minimum Dryer Temp 100°C (212°F)

Density = 115.6 g (dry wt) ÷ 313.662 cm^3 (volume) = 0.3685 g/cm^3

Pellet Fuel Moisture Content Determination

Tare Beaker Wt. ______ g

Wet Wt: ______ g - ______ g = ______ g
Gross Wet Wt. Tare Beaker Wt. Net Wet Wt.

Dry Wt: ______ g - ______ g = ______ g
Gross Dry Wt. Tare Beaker Wt. Net Dry Wt.

% Moisture Dried Basis: ______ %
[1 - (Net Dry Wt ÷ Net Wet Wt.)] X 100

Pre Burn Start WT.
3.5 lbs. l/p 770.6 lbs.
Test Start wt. Range
767.1-766.5 lbs.

PRE BURN DATA
RECORD SHEET #13
WST2-Form16

BARO. PRESSURE 28.58

Unit: Kuma Ashwood Date: 2-19-09
Run: EPA4 Technician(s): ATM JRP
Page: 1 of 1 PDG

Hot Box On ✓

Minute	Time	Scale Weight	Burn Rate	T/C#-3 Stack	4 Stove Top	5 Left Side	6 Back	7 Right Side	8 Bottom	9 Firebox	10 2nd Burn	17	11 Room Temp	Static	Comments (Raked FWD @ 36 min.)
0	1135	770.6	0	512	990	583	396	596	381	1001	1336	1135	79	-.073	Primary Air Set at 3655 (2.3735" THAT rod)
5	40	769.9	.7	457	970	601	402	600	390	952	1251	1155	81	-.064	Secondary Air Set at
10	45	769.3	.6	405	910	602	404	601	396	938	1342	1302	80	-.060	Fan: on hi @ 1004 - Low @ 310
15	50	768.7	.6	391	889	599	412	594	398	934	1390	1127	80	-.059	Tunnel on at: 1205
20	55	768.2	.5	372	878	595	414	585	396	926	1375	1219	80	-.057	Buckets Iced ✓
25	1200	767.9	.3	346	833	592	411	581	393	927	1333	1360	80	-.053	Analyzers Spanned
30	05	767.7	.2	298	730	582	416	565	387	902	1150	1221	81	-.047	Pumps turned on at:
35	10	767.6	.1	285	692	574	416	556	385	893	1153	1203	80	-.043	524.6 ΔT ΔΔT
40	15	767.5	.1	283	625	555	412	542	382	865	1025	926	80	-.042	503.2 - 21.4
45	20	767.4	.1	261	587	538	402	527	378	829	933	672	80	-.040	Check WB/DB: 486.4 -16.8
50	25	767.3	.1	250	550	520	393	511	376	799	880	653	80	-.038	470.0 -16.4
55	30	767.2	.1	243	517	503	380	495	373	769	851	933	80	-.036	453.6 -16.4
		-												-	Probe In Tunnel
60	1235	767.2	0	235	493	489	370	482	371	749	836	806	80	-.034	Tunnel ΔP 441.0 -12.6
65	1240	767.1	.1	231	474	476	362	469	369	732	825	791	79	-.034	430.0 -11.
70															
75															
80															
85															
90															
															Raked FWD @ Flameout
		☆ Raked	Fwd	@ 36	min										or 30 mins. (36 min)
															Start 430-433

Myren Consulting Inc Data Sheet P1 of 6 Unit Kuma Ashwood Date 2 / 14 / 04 Run F-UA4
Test En[illegible] 767.1 ΔT 430.0 Barometric Pressure 26.5 "hg Gas Flows @ 1.5" Technician(s) ATM JRP DG

Time E/T min	Time	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
0	1240	780.4	13.3	0	.258	6.43		13.67	.159	1.59	4.0	~~Pan off~~				231	-.034
05	45	779.7	12.6	.17	.244	6.08		14.45	.074	.74	8.2	m				345	-.054
10	50	779.4	12.3	.13	.248	6.18		14.19	.105	1.05	6.9	m				302	-.045
15	55	779.1	12.0	.13	.201	5.02		15.35	.105	1.05	4.8	m-mH				260	-.042
20	1300	778.8	11.7	.13	.200	5.00		15.32	.116	1.16	4.13	m-mH				247	-.040
25	05	778.5	11.4	.13	.214	5.34		14.92	.127	1.27	4.2	mH				239	-.038
30	10	778.1	11.0	.14	.258	6.43		13.76	.141	1.41	4.6	" Fan on				238	-.038
35	15	777.6	10.5	.15	.390	9.69		10.58	.125	1.25	7.8	"				249	-.040
40	20	777.1	10.0	.15	.603	14.96		5.17	.154	1.54	9.7	m-mL ~~3845 balance~~				293	-.046
45	25	776.5	9.4	.16	.607	15.05		5.32	.106	1.06	14.2	Light 3830	PC 5 checked thru			310	-.048
50	30	776.1	9.0	.14	.576	14.29		6.38	.047	.47	30.4	L-W				314	-.048
55	35	775.6	8.5	.15	.564	13.99		6.56	.070	.70	20.0	"				307	-.046
Tot																3335	.521

Time E/t	Time	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2nd burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 #19	Tube 3 #20
0	1240	474	476	342	469	369	732	825	79	97	222	34	77	58	791			
05	45	454	463	359	453	366	632	1257	80	121	245	35	61	37	986			
10	50	529	465	347	445	363	610	961	80	106	248	34	63	36	616			
15	55	502	446	334	426	362	579	883	79	100	236	34	63	36	755			
20	1300	478	427	322	410	359	560	699	79	96	220	35	62	36	623			
25	05	459	412	311	400	355	555	660	79	97	215	35	62	36	612			
30	10	447	400	301	387	349	560	972	79	96	221	36	62	36	903			
35	15	452	394	292	366	341	578	1221	79	97	223	36	62	36	1163			
40	20	525	399	283	390	332	607	1272	79	98	222	37	62	36	1246			
45	25	596	410	276	399	325	644	1279	79	99	223	37	62	36	1255			
50	30	640	421	270	413	317	671	1302	79	99	224	36	62	36	1233			
55	35	644	431	266	421	311	697	1333	79	99	222	36	62	36	1292			
Tot		6200	5744	3723	5001	4151	7425	13072	950									

Myren Consulting Inc Data Sheet P2 of 6 Unit Kuma Ashwood Date 2 / 14 / 09 Run FPA4

Test En). 7671 ΔT 430.0 Barometric Pressure 28.5 "hg Gas Flows @ 1.5" Technician(s) ATM JRP DG

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
60	1340	775.1	8.0	.5	.581	14.41		6.02	.093	.93	15.5	L-W				310	-.048
65	45	774.7	7.6	.4	.1594	14.73		5.72	.089	.89	16.6	Light				311	-.048
70	50	774.2	7.1	.5	.631	15.65		4.66	.115	1.15	13.6	"				315	-.048
75	55	773.7	6.6	.5	.610	15.13		5.12	.130	1.30	11.6	"				315	-.048
80	1400	773.3	6.2	.4	.596	14.83		5.53	.108	1.08	13.7	L-W				314	-.048
85	05	772.9	5.8	.4	.558	13.84		6.54	.103	1.03	13.4	L				305	-.047
90	10	772.4	5.3	.5	.558	13.84		6.47	.117	1.17	11.8	"				301	-.046
95	15	772.0	4.9	.4	.560	13.89		6.36	.130	1.30	10.7	wispy 4 cracked - sagging				296	-.045
100	20	771.7	4.6	.3	.520	13.10		7.31	.097	.97	13.5	"				292	-.044
105	25	771.3	4.2	.4	.487	12.09		8.30	.102	1.02	11.9	L-m 4 thru - [illegible]				283	-.042
110	30	771.0	3.9	.3	.481	11.94		8.34	.123	1.23	9.7	"				272	-.041
115	35	770.7	3.6	.3	.511	12.68		7.66	.111	1.11	11.4	L-m				275	-.042
Tot																3591	.547

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2^{nd} burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 #19	Tube 3 #20
60	1340	654	438	264	426	306	721	1340	79	99	220	39	83	36	1279			
65	45	664	446	262	435	300	752	1353	79	98	219	38	82	36	1277			
70	50	676	453	264	443	297	778	1374	79	99	221	39	83	36	1363			
75	55	690	462	246	453	294	797	1327	79	99	224	36	83	37	1341			
80	1400	702	467	270	460	291	799	1290	79	99	226	37	83	37	1326			
85	05	692	473	277	466	280	803	1273	79	96	224	37	83	36	1355			
90	10	678	479	286	471	267	810	1291	79	96	220	37	83	37	1331			
95	15	666	485	296	475	265	621	1290	79	98	216	37	83	37	1305			
100	20	658	491	303	480	284	813	1231	79	96	219	37	83	37	1370			
105	25	645	496	309	485	282	809	1203	79	97	221	37	83	37	1304			
110	30	620	496	313	485	281	807	1212	79	96	221	37	82	37	1363			
115	35	617	500	315	488	280	811	1240	79	96	221	37	82	37	1345			
Tot		7962	5606	3425	5569	3475	9521	15424	948									

Myren C[illegible]sulting Inc Data Sheet P3 of 6 Unit Kuma Ashwood Date 2 / 19 / 09 Run 9A4

Test En[illegible] 767.1 ΔT 430.0 Barometric Pressure 28.53 "hg Gas Flows @ 1.5" Technician(s) ATM JRP

Time E/T min	Time	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
120	1440	770.4	3.3	.13	.483	11.99		8.30	.122	1.22	9.8	L-m middle of 5 feet - blacky @ 2"				268	-.040
125	45	770.1	3.0	.13	.424	10.53		9.92	.110	1.10	9.6	"				259	-.039
130	50	770.0	2.9	.1	.389	9.67		10.61	.125	1.25	7.7	m				248	-.037
135	55	769.8	2.7	.12	.376	9.35		10.97	.116	1.16	8.1	L pc 2 bkn thru				238	-.035
140	1500	769.7	2.6	.1	.349	8.68		11.51	.142	1.42	6.1	"				231	-.033
145	05	769.6	2.5	.1	.304	7.57		12.55	.156	1.56	4.9	wispy				224	-.032
150	10	769.5	2.4	.1	.304	7.57		12.49	.168	1.68	4.5	clear				218	-.031
155	15	769.4	2.3	.1	.297	7.39		12.67	.168	1.68	4.4	"				215	-.030
160	20	769.3	2.2	.1	.298	7.42		12.53	.190	1.90	3.9	"				212	-.029
165	25	769.2	2.1	.1	.293	7.30		12.52	.217	2.17	3.4					208	-.027
170	30	769.1	2.0	.1	.246	6.13		12.98	.358	3.58	1.7					205	-.027
175	35	769.0	1.9	.1	.237	5.91		13.22	.353	3.53	1.7					202	-.026
Tot																2728	.386

Time E/t	Time	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2nd burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 #19	Tube 3 #20
120	1440	610	503	322	491	280	811	1194	79	96	221	37	62	37	1363			
125	45	588	503	323	469	279	815	1141	79	95	220	37	62	37	1357			
130	50	564	496	323	466	278	820	1159	78	94	219	37	62	37	1332			
135	55	536	492	325	483	278	813	1129	78	93	216	37	62	37	1082			
140	1500	519	484	323	480	277	800	1003	78	93	217	37	61	37	1032		4T	4.4T
145	05	496	472	322	473	277	795	1025	78	93	224	37	61	37	1047		408.4	-.216
150	10	478	462	322	462	277	791	1000	79	93	225	37	62	37	1115			
155	15	466	457	322	455	277	761	970	79	93	221	37	62	37	1026			
160	20	456	453	321	449	278	746	959	79	93	216	37	62	37	1020		391.4	-.381.6
165	25	443	447	320	441	278	758	861	79	93	219	37	62	37	886			
170	30	431	440	320	434	778	740	828	80	94	222	37	63	37	665		380.6	-49.4
175	35	419	432	319	428	278	723	812	80	94	224	37	63	37	652			
Tot		6008	5643	3862	5571	3335	9423	12082	946									

Myren Consulting Inc Data Sheet P4 of 6 Unit Kuma A' 1000 Date 2/19/09 Run PPA4
Test Eng. Wt. 767.1 ΔT 430.0 Barometric Pressure 28.56 "hg Gas Flows @ 1.5" Technician(s) ATM JRP

Time E/T min	Time	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
180	1540	768.9	1.8	.1	.233	5.81		13.36	.345	3.45	1.7	clear				198	-.026
185	45	768.9	1.8	0	.232	5.79		13.36	.351	3.51	1.6					197	-.025
190	50	768.8	1.7	.1	.232	5.79		13.39	.345	3.45	1.7					192	-.025
195	55	768.7	1.6	.1	.228	5.69		13.50	.342	3.42	1.7					191	-.024
200	1600	768.7	1.6	0	.224	5.59		13.60	.342	3.42	1.6					189	-.024
205	05	768.6	1.5	.1	.273	6.80		12.97	.225	2.25	3.0	2 is thru - 4(rt) has fallen straight down				186	-.023
210	10	768.5	1.4	.1	.277	6.90		12.80	.240	2.40	2.9					185	-.023
215	15	768.4	1.3	.1	.305	7.59		12.51	.160	1.60	4.7					182	-.023
220	20	768.4	1.3	0	.306	7.62		12.36	.185	1.85	4.1					182	-.023
225	25	768.3	1.2	.1	.308	7.67		12.40	.167	1.67	4.6					182	-.023
230	30	768.2	1.1	.1	.311	7.74		12.27	.179	1.79	4.3					180	-.022
235	35	768.2	1.1	0	.301	7.49		12.42	.198	1.98	3.8					181	-.022
Tot																2245	.283

Time E/t	Time	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2nd burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 ~~#19~~	Tube 3 ~~#20~~
180	1540	409	426	318	423	279	712	803	80	94	222	37	63	37	644		371.0	-59.0
185	45	399	420	318	417	278	701	788	80	94	217	37	64	37	634			
190	50	390	414	317	412	278	690	782	80	94	214	37	63	37	626		362.2	-67.8
195	55	384	410	317	408	278	680	767	80	94	214	37	64	37	623			
200	1600	377	406	316	403	278	670	766	81	94	216	37	64	37	606		356.0	-74.0
205	05	372	403	316	400	278	642	792	81	94	222	37	64	37	830			
210	10	368	401	317	399	277	658	785	81	93	223	37	64	37	832		352.4	-77.6
215	15	365	399	317	397	276	663	798	81	93	222	37	64	37	797			
220	20	364	399	319	395	276	666	806	81	93	221	37	64	37	804		350.6	-79.4
225	25	363	399	324	394	275	668	817	81	93	221	37	64	37	614			
230	30	362	399	327	394	274	667	819	80	93	222	37	64	37	620		351.2	-78.8
235	35	361	400	326	393	274	663	808	80	93	222	37	64	37	613			
Tot		4574	4876	3834	4835	3321	8102	9531	966									

Myren C[illegible]nsulting Inc Data Sheet P5 of 6 Unit Kuma As [illegible]000 Date 2 / 19 / 09 Run PA4
Test E[illegible]t 767.1 ΔT 430.0 Barometric Pressure 28.51 "hg Gas Flows @ 1.5" Technician(s) AMM JRP PDT

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
240	1640	768.1	1.0	.1	.300	7.47		12.38	.211	2.11	3.5						
245	45	768.0	.9	.1	.288	7.17		12.73	.200	2.00	3.6					179	-.022
250	50	768.0	.9	0	.280	6.97		12.89	.207	2.07	3.4					178	-.022
255	55	767.9	.8	.1	.280	6.97		12.90	.206	2.06	3.4					178	-.022
260	1700	767.8	.7	.1	.274	6.83		13.05	.204	2.04	3.4					177	-.022
265	05	767.7	.6	.1	.254	6.33		13.57	.200	2.00	3.2					176	-.022
270	10	767.7	.6	0	.230	5.74		14.04	.225	2.25	2.6					176	-.022
275	15	767.6	.5	.1	.220	5.49		14.19	.244	2.44	2.3					175	-.022
280	20	767.6	.5	0	.215	5.37		14.32	.242	2.42	2.2					174	-.022
285	25	767.5	.4	.1	.222	5.54		14.19	.233	2.33	2.4					172	-.022
290	30	767.5	.4	0	.224	5.59		14.19	.225	2.25	2.5					172	-.021
295	35	767.4	.3	.1	.222	5.54		14.22	.228	2.28	2.4					170	-.021
Tot																169 2096	-.021 .261

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2nd burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Tube 1 #17	Tube 2 #18	Tube 3 ΔT ~~#19~~	H_2O H box ΔT ~~#20~~
240	1640	360	399	332	391	273	659	993	81	92	222	37	64	37	615			
245	45	360	398	328	390	273	658	767	61	92	222	37	64	37	635		351.0	-79.0
250	50	358	396	324	388	272	655	764	60	92	222	37	63	37	630			
255	55	356	394	321	386	272	648	773	80	92	223	37	63	37	614		347.6	-82.4
260	1700	355	393	320	385	271	645	771	80	92	223	37	63	37	619			
265	05	353	391	319	385	271	636	764	81	92	224	37	63	37	776		344.6	-85.2
270	10	350	388	316	383	271	629	736	61	92	224	37	63	37	750			
275	15	346	385	313	380	271	620	717	60	92	223	37	64	37	738		341.6	-88.4
280	20	342	381	311	376	270	608	707	80	92	222	37	63	37	730			
285	25	339	378	310	372	270	602	699	81	92	221	37	63	38	727		336.0	-94.0
290	30	335	375	309	368	270	596	690	81	92	221	37	64	38	718			
295	35	331	372	308	364	269	589	681	81	92	222	37	64	38	710		331.4	-98.6
Tot		4185	4650	3811	4568	3253	7547	8902	967									

Myren [illegible]sulting Inc Data Sheet P6 of 6 Unit Kuma A 1000 Date 2/19/09 Run PA4
Test En[illegible]t 767.1 ΔT 430.0 Barometric Pressure 28.50 "hg Gas Flows @ 1.5" Technician(s) ATW JRP PDG

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
300	1740	767.3	12	.1	.225	5.61		14.12	.239	2.34	2.4						
305	45	767.3	12	0	.226	5.64		14.10	.233	2.33	2.4					168	-.020
310	50	767.2	11	.1	.222	5.54		14.10	.252	2.52	2.2					167	-.020
315	55	767.2	11	0	.226	5.64		14.02	.239	2.39	2.4					167	-.020
320	1800	767.1	0	.1	.223	5.57		14.06	.255	2.55	2.2					165	-.020
325																165	-.020
330																833	.100
335															Total	14827	2.098
340														AVG	÷65	228	.032
345																	
350																	
355																	
Tot																	

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2nd burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Tube 1 #17	Tube 2 #18	~~Tube 3~~ ΔT ~~#19~~	~~H2O H box~~ ΔT ~~#20~~
300	1740	326	370	306	360	268	583	676	61	92	222	37	64	36	707		326.4	-103.6
305	45	325	366	305	357	267	576	670	61	92	222	37	64	36	703			
310	50	323	366	303	353	266	573	665	61	91	222	37	64	36	705		322.2	-107.8
315	55	321	364	302	350	265	569	663	81	91	222	36	64	36	699		320.4	-109.6
320	1800	319	362	302	348	263	567	664	80	91	221	36	63	36	709		318.8	-111.2
325		1616	1830	1518	1768	1329	2868	3338	404									
330		30485	27829	20173	17312	18864	44886	62349	518	Total								
335		469	428	310	420	290	691	959	80	AVG	÷65				Delta T			
340															Start	430.0		
345															Stop	318.8		
350															ΔDT	-111.2		
355																		
Tot																		

WST6-Form8 Rev 5/96

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-1

Site: Myren Consulting, Colville [redacted], WA Date: 2/19/09 Analyte: CO_2

Source: Kuma Ashwood Run #: EPA 4

Zero Cyl #: TC 3AAM154 Conc. 00.0 % CO_2 Cyl Press: 1510 psi

Certified by: Oxarc Date: 11/12/07

Span Cyl #: AS 90457 Conc. 12.5 % CO_2 Cyl Press: 1470 psi

Certified by: Matheson Tri Gas Date: 2/2/09

Analyzer: Make: Horiba Model: PIR-2000 SN: 607024

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

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter: ____

EPA Span Value = 25.0% CO_2

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

Pre Run Audit: By: A.F. Myren Time: 1140 Temp: 78 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.000	.050453	+0.050453	+0.22
Span	50.00	.500	12.5	49.75	.499	12.3858	-0.11425	-0.91

Comments:

Post Run Audit: By: A.F. Myren Time: 1855 Temp: 77 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.000	.050453	+0.050453	+0.22
Span	50.00	.500	12.5	49.5	.498	12.36104	-0.13896	-1.11

Comments:

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

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

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

WST6-Form10 Rev 5/96

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-3

Site: Myren Consulting, ~~Woodinville~~ Colville, WA Date: 2/19/09 Analyte: CO

Source: Kuma Ashwood Run #: EPA 4

Zero Cyl #: TC3AAM 154 Conc. 00.0 % CO Cyl Press: 1510 psi

Certified by: Oxarc Date: 11/12/07

Span Cyl #: A590457 Conc. 2.00 % CO Cyl Press: 1470 psi

Certified by: Matheson Tri Gas Date: 2/2/09

Analyzer: Make: HORIBA Model: Mexa 311GE SN: GE-30075

Range: 0 - 10.0% CO Analyzer Output: 0 - 100 mv.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter: ____

EPA Span Value = 5.0% CO

EPA Control Limits = ±2.5% of 5.0% CO = ± 0.125% CO

Pre Run Audit: By: A.T. Myren Time: 1140 Temp: 78 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.00	.000	-.00443	-0.00443	-0.04
Span	2.00	.200	2.00	1.97	.197	1.9758	-0.0242	-1.210

Comments:

Post Run Audit: By: A.T. Myren Time: 1855 Temp.: 77 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.00	.000	-.00443	-0.00443	-0.04
Span	2.00	.200	2.00	1.96	.196	1.9657	-0.03426	-1.71

Comments:

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

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

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

Unit: Kuma Ashwood
Run: EPA 4
Date: 2/19/99
Technicians: AJM JRP PDG
WST5-Form3-Rev11/89

QUALITY CHECKS
WOODSTOVE DATA SHEET #16

Ambient = Tr: ______ °F T/C#30: ______ °F

Thermocouple Check (at ambient): T/C#1: — °F; T/C#2: 68.6 °F;

T/C #3: 71.0 °F;	T/C #4: 71.9 °F;	T/C #5: 73.5 °F;
T/C #6: 71.9 °F;	T/C #7: 72.3 °F;	T/C #8: 72.8 °F;
T/C #9: 74.0 °F;	T/C #10: 74.0 °F;	T/C #11: 64.8 °F;
T/C #12: 71.1 °F;	T/C #13: 68.0 °F;	T/C #14: 63.4 °F;
T/C #15: 67.7 °F;	T/C #16: 59.0 °F;	T/C #17: 74.4 °F;
T/C #18: — °F;	T/C #19: ______ °F;	T/C #20: ______ °F;
T/C #21: ______ °F;	T/C #22: ______ °F;	T/C #23: ______ °F;
T/C #24: ______ °F;	T/C #25: ______ °F;	T/C #26: ______ °F;

Comments: ______

Thermocouple Readout: Pretest Zero/Span Check and Calibration:

Zero (0°F): 0.2 °F	Adj to: — °F	Post Test Check Zero (0°F): 1.0 °F	% Difference +0.22
Span (2000°F): 2000.7 °F	Adj to: — °F	Span (2000°F): 2002.4 °F	+0.10

(Allowable % Difference = 1.5%. Use formulas on Woodstove Data Sheet #15 to calculate % Difference) In Degrees Absolute.

Thermocouple Readout Pretest Linearity Check

0°F = 0.2 °F;	200°F = 202.2 °F;	400°F = 399.5 °F;
600°F = 601.7 °F;	800°F = 802.0 °F;	1000°F = 1001.2 °F;
1200°F = 1199.0 °F;	1400°F = 1400.0 °F;	1600°F = 1600.6 °F
1800°F = 1800.7 °F;	2000°F = 2000.8 °F	

Combustion Gas (CO_2, O_2, CO) Train Leak Check: Pre ✓ OK PDG Post ✓ OK PDG

Draft (Static) Guage Zero Check: Pre ✓ JRP Post ✓ OK AJM

Scale Check Pre (Wt, #'s): 768.8 − 763.8 = 5.0 lbs / 5.0 lbs = OK AJM

Post (Wt, #'s): 771.9 − 766.9 = 5.0 lbs / 5.0 lbs = OK AJM

Stack cleaned prior to the run: Yes ______ No ✓

Tunnel cleaned prior to the run: Yes ______ No ✓

EP/ LOW

MYREN CONSULTING CERTIFICATION TEST DATA

DILUTION TUNNEL CALCULATIONS

1\25\09, Md=28.56, Bws=4% 6" Tunnel

File Name:	EPA 6
Manufacturer:	KUMA
Model Number:	ASHWOOD
Lab Name:	MYREN
Test Date:	2\27\09
Run Number:	EPA 6
Meter Box Y Factor:	1.0177
Barometric pressure (in):	28.728
Gas meter temp (ave):	**85**
delta H(avg):	**0.900**
Gas meter initial reading:	603.1000
Gas meter final reading:	734.8090
Front catch (acetone) mg:	5
first filter catch (mg):	19.8
second filter catch (mg):	0.6
Tunnel Flow (Qsd) (dscfm)	**145.642**
Emission Rate(g/hr):	**1.776**
Emission Rate(M5H) :	**2.931**
Avg. of Delta P Sq. Roots:	**0.2023**
Vs (Avg.)(ft/min):	**843.500**
Tunnel Avg. Temperature (F):	**93.077**
Test time(min):	250
Fuel Load(lb. wet):	13.314
Wood moisture(%wet):	17.264
Burn rate(dry kg/hr):	**1.199**
Sample Volume (dscf)	**125.002**
Avg. Tunnel Static (-inch H2O):	**0.1638**
Room Blank Catch (mg/dscf):	0
Emission Factor (g/kg):	**1.4807**
Pitot Correction Factor:	0.9624
front filter number	716
back filter number	715
Beaker Number:	26
PRELIMINARY RESULTS	
FINAL RESULTS:	AUDITED
DATA SUMMARY	
MODEL:	ASHWOOD
RUN:	EPA 6
DATE:	2\27\09
DBR:	1.199
EMISSION RATE (g/hr)(M5H)	2.9311
EMISSION FACTOR (g/kg):	1.4807
AVG. % PROPORTIONALITY :	100.111

RUN TIME (min)	PITOT DELTAP (- INCH H20)	TNL TEMP (°F)	GAS METER RDG (ft3)	GAS METER TEMP (°F)	GAS METER DELTA H (in.H2O)	TUNNEL VELOCITY (ft/min)	PROP RATE (%)	dDGM vol std (ft3)	Tunnel Static (- Inch H2O)	SQUARE ROOT DELTA P	DRY GAS METER RDG (m3)
0	0.041	94	603.1000	68	0.900	845.10			0.163	0.2025	
10	0.042	101	608.4090	70	0.900	860.73	105.8	5.178	0.167	0.2049	
20	0.042	97	613.6550	73	0.900	857.66	103.0	5.088	0.168	0.2049	
30	0.042	99	618.8680	76	0.900	859.20	101.4	5.027	0.168	0.2049	
40	0.041	101	624.0720	80	0.900	850.42	101.1	4.982	0.166	0.2025	
50	0.041	100	629.2750	82	0.900	849.66	100.2	4.962	0.164	0.2025	
60	0.040	99	634.4680	83	0.900	838.49	100.8	4.944	0.165	0.2000	
70	0.041	99	639.6950	85	0.900	848.91	99.5	4.958	0.167	0.2025	
80	0.041	97	644.9460	86	0.900	847.39	99.4	4.971	0.165	0.2025	
90	0.040	95	650.2040	86	0.900	835.48	100.6	4.978	0.163	0.2000	
100	0.040	94	655.4640	87	0.900	834.73	100.2	4.971	0.162	0.2000	
110	0.040	91	660.7360	87	0.900	832.47	100.2	4.982	0.163	0.2000	
120	0.040	91	666.0160	87	0.900	832.47	100.3	4.990	0.163	0.2000	
130	0.040	92	671.2870	87	0.900	833.22	100.2	4.981	0.163	0.2000	
140	0.041	90	676.5750	88	0.900	842.04	98.8	4.988	0.163	0.2025	
150	0.040	91	681.8560	88	0.900	832.47	100.0	4.981	0.163	0.2000	
160	0.041	90	687.1480	88	0.900	842.04	98.8	4.992	0.163	0.2025	
170	0.040	91	692.4330	89	0.900	832.46	99.7	4.976	0.162	0.2000	
180	0.041	91	697.7300	88	0.900	842.81	99.0	4.997	0.163	0.2025	
190	0.040	90	703.0180	89	0.900	831.71	99.6	4.979	0.161	0.2000	
200	0.040	89	708.3200	89	0.900	830.95	99.8	4.992	0.163	0.2000	
210	0.041	89	713.6160	89	0.900	841.28	98.5	4.987	0.162	0.2025	
220	0.041	88	718.9100	89	0.900	840.51	98.3	4.985	0.163	0.2025	
230	0.041	88	724.2030	89	0.900	840.51	98.3	4.984	0.162	0.2025	
240	0.040	87	729.5070	89	0.900	829.44	99.7	4.994	0.164	0.2000	
250	0.040	86	734.8090	89	0.900	828.68	99.5	4.992	0.163	0.2000	
260			0.0000			0.00	0.0	0.000		0.0000	
270			0.0000			0.00	0.0	0.000		0.0000	
280			0.0000			0.00	0.0	0.000		0.0000	
290			0.0000			0.00	0.0	0.000		0.0000	
300			0.0000			0.00	0.0	0.000		0.0000	
310			0.0000			0.00	0.0	0.000		0.0000	
320			0.0000			0.00	0.0	0.000		0.0000	
330			0.0000			0.00	0.0	0.000		0.0000	
340			0.0000			0.00	0.0	0.000		0.0000	
350			0.0000			0.00	0.0	0.000		0.0000	
360			0.0000			0.00	0.0	0.000		0.0000	
370			0.0000			0.00	0.0	0.000		0.0000	
380			0.0000			0.00	0.0	0.000		0.0000	

METHOD 5G-1 (EPA) **PARTICULATE SAMPLING DATA** **Rev. 2/09**

DATE: 2/27/09 **PAGE** 1 **OF** 2 **UNIT:** Kuma Ashwood **RUN:** EPA 6

METER BOX: 456-P **METER Y:** 1.0177 **FILTER #'S: (F)** 716 **(R)** 715

.941 / .9415

PRE TEST LEAK CHECK: .0005 **CFM @** -16.0 **IN HG** **FILTER SIZE:** 110 **mm**

.865 | .866

POST TEST LEAK CHECK: .001 **CFM @** -15.8 **IN HG** **PROBE LENGTH** 21 **IN**

TIME		METER READING	PITOT		TUNNEL TEMP	METER TEMP	GAS METER	VAC
CLOCK	ELAPSED	(FT³)	ΔP	Pg	(°F)	(°F)	Δh	(in Hg)
1345	00	603.100	.041	-.163	94	66	.90	0
55	10	608.409	.042	-.167	101	70	.90	0
1405	20	613.655	.042	-.166	97	73	.90	0
15	30	618.868	.042	-.168	99	76	.90	0
25	40	624.072	.041	-.166	101	80	.90	0
35	50	629.275	.041	-.164	100	82	.90	0
45	60	634.468	.040	-.165	99	83	.90	0
55	70	639.695	.041	-.167	99	85	.90	0
1505	80	644.946	.041	-.165	97	86	.90	0
15	90	650.204	.040	-.163	95	86	.90	0
25	100	655.464	.040	-.162	94	87	.90	0
35	10	660.736	.040	-.163	91	87	.90	0
45	120	666.016	.040	-.163	91	87	.90	0
55	30	671.287	.040	-.163	92	87	.90	0
1605	40	676.575	.041	-.163	90	88	.90	0
15	50	681.856	.040	-.163	91	88	.90	0
25	60	687.148	.041	-.163	90	88	.90	0
35	70	692.433	.040	-.162	91	89	.90	0
45	180	697.730	.041	-.163	91	88	.90	0
55	90	703.018	.040	-.161	90	89	.90	0

BP

00	28.73	250	28.725
60	28.73		
120	28.73		
180	28.73		
240	28.725	AVG. =	28.729

Pre Test Filter Check Weighing
F .6695
R .6747

End of Test Weight
F .6901 R .6752
.6690 .6744
.0211 .0008

17,26[illegible]
13,314 lbs.

METHOD 5G -1 (EPA) PARTICULATE SAMPLING DATA Rev. 2/09

DATE: 2/27/09 PAGE 2 OF 2 UNIT: Kuma Ashwood RUN: EPA6

METER BOX: 45G-P METER Y: 1.0177 FILTER #'S: (F) 716 (R) 715

.941/.9415
PRE TEST LEAK CHECK: .0005 CFM @ -16.0 IN HG FILTER SIZE: 110 mm

POST TEST LEAK CHECK: .001 CFM @ -15.8 IN HG PROBE LENGTH 21 IN

TIME		METER READING (FT^3)	PITOT		TUNNEL TEMP (°F)	METER TEMP (°F)	GAS METER Δh	VAC (in Hg)
CLOCK	ELAPSED		ΔP	Pg				
1705	200	708.320	.040	-.163	89	89	.90	0
15	10	713.616	.041	-.162	89	89	.90	0
25	20	718.910	.041	-.163	88	89	.90	0
35	30	724.203	.041	-.162	88	89	.90	0
45	240	729.507	.040	-.164	87	89	.90	0
55	250	734.809	.040	-.163	86	89	.90	0
	60							
	70							
	80							
	90							
	00							
	10							
	20							
	30							
	40							
	50							
	60							
	70							
	80							
	90							

BP

00	28.73	250	28.725
100	28.73		
120	28.73		
180	28.73		
240	28.725	AVG. =	

Pre Test Filter Check Weighing
F .16595
R .10247

End of Test Weight
F .16590 R .06744

MYREN CONSULTING, INC.

Dilution Tunnel Traverse Data with 8 Traverse Points

Unit: Kuma Ashwood
Run #: EPA6
Date: 2.27.09
Technicians: ATM JRP PDG
Rev 2/16/09

Point	Location	Δp	$\sqrt{\Delta p_{trav}}$	Δp	$\sqrt{\Delta p_{cent}}$	#12 T_{trav}	#12 T_{cent}	Pg
W-1	0.5″	.035	.1871			97		
2	1.5	.041	.2025			97		
Center	Center			.041	.2025		98	-.159
3	4.5	.040	.2000			98		
4	5.5	.038	.1949			98		
S-1	0.5	.032	.1789			96		
2	1.5	.037	.1924			96		
Center	Center			.040	.2000		96	-.156
3	4.5	.040	.2000			96		
4	5.5	.038	.1949			95		
	Totals		1.5507		.4025	773	194	-.315
	Average		.1938		.2013	96.625	97	-.1575
	°R = (°F + 460)					556.6	557	

Ps = BP + (-Pg/13.6) = 28.74 + (-.1575 /13.6) = 28.728 ″Hg

LEAK CHECKS:

Pre Test: Pg Leg: OK JRP Velocity Head Leg: OK PDG

Post Test: Pg Leg: OK PDG Velocity Head Leg: OK PDG

DILUTION TUNNEL GAS VELOCITY & VOLUMETRIC FLOW RATE CALCULATIONS Rev 4/19/08

UNIT: Kuma Ashwood DATE: 2.27.09 RUN #: EPA6 TECHNICIAN(S): ATM JRP PDG

Average Gas Velocity in the Dilution Tunnel Vstrav (EPA M2 EQN 2-9, ASTM E 2515-07 EQN 7)

(9) Vstrav = (85.49) (0.99 cp) {2} (.1938 {2} $\overline{x}$ $\sqrt{\Delta P}$ "H_2O) $\sqrt{\dfrac{556.6 \text{ Ts °A } \{0\}}{(28.728 \text{ Ps "Hg}) \{2\} (28.56 \text{ lb./ lb. mole})}}$ = 13.50965 fps {2}

(9A) Vs = (13.50965 {2} fps) (60) = 810.579 {2} fpm

Gas Velocity in the Center of the Dilution Tunnel - Vscent (EPA M2 EQN 2-9, ASTM E 2515-07 EQN 7)

(9) Vscent = (85.49) (0.99 cp) {2} (.2013 {2} $\overline{x}$ $\sqrt{\Delta P}$ "H_2O) $\sqrt{\dfrac{557 \text{ Ts °A } \{0\}}{(28.728 \text{ Ps "Hg}) \{2\} (28.56 \text{ lb./ lb. mole})}}$ = 14.03751 fps {2}

(9A) Vs = (14.03751 {2} fps) (60) = 842.251 {2} fpm

EPA M5G1 Section 4.2.2, ASTM E 2515-07 EQN 1 Adjustment Factor for Center of Tunnel Pitot Tube Location

Fp = Vstrav/ Vscent = 13.50965 ÷ 14.03751 = .96240

Average Stack Gas Dry Volumetric Flow Rate - Qsd (EPA M2 EQN 2-10, ASTM E 2515-07 EQN 3)

(10) Qsd = 3600(1 - 0.04 Bws) (13.50965 {2} fps) (.1963 {3} ft^2) [(528 °A) (28.728 {2} Ps "Hg) / (556.6 {0} T_s °A) (29.92" Hg) = 8347.812 {1} dscfhr (or dscfh)

(10A) 8,347.812 {1} dscfhr ÷ 60 = 139.130 {1} dscfmin (or dscfm)

Note: Number in { } under blank lines denotes number of decimals to be used. If a blank calls for an answer already calculated, use the number of decimals previously specified for that answer.

WST5-Form9,Pg2,Rev1/90

WOODSTOVE DATA SHEET #4-1: INITIAL FILTER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date 1-20-09 Time 1149 By PDG Front Half X Back Half X

Manufacturer: Pall P/N. 60115 Size: 110 Lot.No.: 70726 Grade: A/E Glass

Filter #	First Wt	2009 Date	Time	By	Second Wt	Date	Time	By	Third Wt	2009 Date	Time	By
700	.6873	1-22	1331	GRP	.6877	1-23	1417	PDG				
701	.6871		1330	GRP	.6878		1419	PDG	.6877	1.26	1421	GRP
702	.6816		1329	GRP	.6825		1420	PDG	.6824	1.26	1420	GRP
703	.6761		1328	GRP	.6762		1421	PDG				
704	.6727		1327	GRP	.6732		1422	PDG				
705	.6833		1326	GRP	.6837		1423	PDG				
706	.6946		1325	GRP	.6948		1424	PDG				
707	.6773		1324	GRP	.6777		1425	PDG				
708	.6701		1323	GRP	.6702		1426	PDG				
709	.6799		1322	GRP	.6809		1427	PDG	.6806	1.26	1419	GRP
710	.6587		1321	GRP	.6590		1428	PDG				
711	.6654		1320	GRP	.6656		1429	PDG				
712	.6688		1319	GRP	.6892		1430	PDG				
713	.6864		1318	GRP	.6866		1431	PDG				
714	.6651		1318	GRP	.6655		1432	PDG				
715	.6741		1317	GRP	.6744		1433	PDG	←			
716	.6692		1316	GRP	.6690		1434	PDG	←			
717	.6531		1315	GRP	.6536		1435	PDG				
718	.6721		1314	GRP	.6723		1436	PDG				
719	.6769		1313	GRP	.6769		1437	PDG				
720	.6627		1312	GRP	.6628		1438	PDG				
721	.6567		1311	GRP	.6569		1439	PDG				
722	.6539		1310	GRP	.65340		1440	PDG				
723	.6552		1309	GRP	.6552		1441	PDG				
724	.6655		1308	GRP	.6656		1442	PDG				

Checked by A.T. Myers Date: 1/27/09 Time 1632

QA REWEIGH

Filter #	WT	Date	Time	By
703	.6761	1/27/09	1639	ATM
708	.6705		1640	ATM
715	.6749		1642	ATM

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
57	72	38	1-22-09	1138	ATM
56	75	32	1-23-09	1150	PDG
56	76	25	1-26-09	1359	GRP
58	72	31	1/27/09	1830	PDG

Post	1-22	1.23	1.26
0.0000	0.0000	0.0000	0.0000
100.0000	99.9994	99.9993	99.9993

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date: 9.04.08 Time: 13:33 By: JRP

Beaker #	First Wt	2008 Date	Time	By	Second Wt	2009 Date	Time	By	Third Wt	2009 Date	Time	By
24	73.2197	12/17	1628	JRP	73.2186	1/20	1000	PDG	73.2188	1/20	1635	JRP
25	72.6524		1625	JRP	72.6512		1002	PDG	72.6514		1635	JRP
26	71.7887		1631	JRP	71.7881		1007	PDG	71.7877		1626	JRP
28	70.5985		1627	JRP	70.5976		1003	PDG	70.5977		1632	JRP
29	71.5207		1635	JRP	71.5191		1008	PDG	71.5193		1637	JRP
30	70.7867		1629	JRP	70.7855		1005	PDG	70.7856		1627	JRP
33	53.1490		1632	JRP	53.1483		1012	PDG	53.1486		1633	JRP
34	53.2618		1636	JRP	53.2609		1014	PDG	53.2609		1628	JRP
35	53.2826		1637	JRP	53.2817		1016	PDG	53.2815		1629	JRP
36	53.5752		1638	JRP	53.5742		1010	PDG	53.5744		1634	JRP
42												
43	53.2325		1633	JRP	53.2315		1011	PDG	53.2319		1631	JRP

Checked By: A.T. Myam Date: 1/23/09 Time: 1145

QA REWEIGH

Beaker #	WT	Date	Time	By
35	53.2820	1/23/09	1146	ATM
26	71.7882	1/23/09	1147	ATM
43	53.2323	1/23/09	1149	ATM

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
52	70	25	12/17/08	1619	JRP
58	74	37	1/20/09	0950	PDG
57	73	33	1/20/09	1613	JRP
57	72	38	1/23/09	1138	ATM

WST5-Form9, Pg3, Rev6/90

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Blank done 12/10/07

Into Dessicator: Date: 10/12/07 Time: 0801 By: JRP

Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
22	71.8343	10/22/07	1358	JRP	71.8332	11/10/07	1938		71.8330	11-11-07	1748	Jm
24	73.2192		1400	JRP	73.2190	11/10/07	1940		73.2193	11-11-07	1746	Jm
25	72.6516		1401	JRP	72.6512	11/10/07	1944	← Blank				
X 26	71.7895		1403	JRP	71.7888	11/10/07	1939		71.7886	11-11-07	1747	Jm
27	72.3316		1402	JRP	72.3314	11/10/07	1945					
28	70.5979		1404	JRP	70.5975	11/10/07	1941		70.5977	11-11-07	1745	Jm
39	53.1508		1405	JRP	53.1500	11/10/07	1942					
37	53.7237	11/10/07	1945	[illegible]	53.7238	11/11/07	1743	Jm				

Checked By: ________ Date: ________ Time: ________

QA REWEIGH

Beaker #	WT	Date	Time	By
27	72.3315	11-11	1740	Jm
25	72.6515	11-11	1741	Jm
39	53.1509	11-11	1744	Jm

2nd

Post weighing
0.0000g

LSD
0.0000

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
57	68	50	10/22/07	1344	JRP
			11/10		

WST5-Form9.Pg1,Rev4/90
Unit Ku Ashwood
Run # EPA 6
Date: 2/27/09

WOODSTOVE DATA SHEET #4-3: C ANT FINAL WEIGHTS

55ml

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	2009 Date	Time	By	Third	Date	Time	By
26	71.7932	3/2	1905	ATM	71.7932	3/3	1433	PDG	71.7927	3.4		JRP				

FINAL FILTER WEIGHTS

	Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
F	716	.6901	2/27	1915	ATM	.6890	2/28	1340	ATM	.6888	3/3	1437	PDG				
R	715	.6752	1915	1915	ATM	.6750	2/28	1342	ATM	.6750	3/3	1435	PDG				

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By

Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	2009 Date	Time	By	WB	DB	%RH
1	2/28	1330	ATM	57	74	33
2	3/3	1431	PDG	59	76	35
3	3/4	1556	JRP	56	70	40
4						
5						

SCALE ROOM ENVIRONMENTAL CONDITIONS

6						
7						
8						
9						

Comments

Acerone
Lot #
041648

Blank
done
12/10/07

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

Tare 72.6512

WST5-Form9, Pg1, Rev4/90
Unit Kuma Ashwood
Run # EPA 6
Date: 2/19/09

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	2007 Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
25	✓	12/12	1546	JRP	72.6508	12/13	1342	JRP	72.6511	12/14	1347	Jm				

FINAL FILTER WEIGHTS

Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By

Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	2007 Date	Time	By	WB	DB	%RH
1	12/13	1307	JRP	55	73	29
2	12/14	1321	JRP	57	75	31
3						
4						

SCALE ROOM ENVIRONMENTAL CONDITIONS

6						
7						
8						
9						

Comments

WOODSTOVE DATA SHEET 4-4 SCALE QC RECORD SHEET

FROM: 9/27/2007
THROUGH: 12/7/2007

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

Level	Recalibrated	130 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	129.9998	99.9998	10.0000	1.0000	0.1000	0.0199	9/27/07	1402	GRP	55	67	45
✓	Y	129.9995	99.9996	10.0001	1.0000	0.1000	0.0200	9/28/07	1335	GRP	57	69	46
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0200	10/1/07	1505	ATM	58	70	48
✓	N	129.9995	99.9996	10.0000	1.0001	0.1000	0.0199	10/2/07	1611	GRP	56	68	46
✓	N	129.9997	99.9997	9.9999	1.0001	0.1000	0.0199	10/3/07	1122	GRP	56	68	46
✓	N	129.9996	99.9996	10.0000	1.0000	0.0999	0.0199	10/4/07	1025	GRP	55	67	45
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	10/5/07	0750	GRP	51	62	45
✓	N	129.9997	99.9997	9.9999	1.0000	0.1000	0.0199	10/5/07	1513	GRP	56	69	43
✓	Y	129.9996	99.9996	10.0000	1.0001	0.1001	0.0200	10/9/07	1505	ATM	58	71	44
✓	N	129.9996	99.9997	10.0000	1.0001	0.1001	0.0200	10/12/07	1259	ATM	58	70	48
✓	Y	129.9995	99.9996	9.9999	1.0000	0.1000	0.0199	10/22/07	1344	GRP	57	68	50
✓	Y	129.9996	99.9997	9.9999	1.0000	0.1000	0.0199	10/29/07	1338	GRP	53	63	50
✓	N	129.9995	99.9995	10.0000	1.0000	0.1000	0.0200	10/30/07	0933	ATM	56	70	40
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1000	0.0199	10/30/07	1457	GRP	55	70	36
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	10/31/07	1528	GRP	57	75	30
✓	Y	129.9996	99.9996	9.9999	1.0000	0.0999	0.0199	11/2/07	1238	GRP	52	67	33
✓	Y	129.9996	99.9996	10.0000	1.0001	0.1000	0.0199	11/5/07	0730	GRP	57	73	35
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1001	0.0201	11/9/07	1550	ATM	58	70	48
✓	N	129.9996	99.9997	10.0000	1.0000	0.1000	0.0200	11/10/07	1835	ATM	58	71	44
✓	Y	129.9997	99.9997	9.9999	1.0000	0.1000	0.0199	11/11/07	1810	ATM	55	69	39
✓	N	129.9997	99.9996	9.9999	1.0000	0.1000	0.0199	11/12/07	0822	GRP	54	67	41
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	11/13/07	1226	ATM	58	72	41
✓	N	129.9998	99.9997	9.9999	0.9999	0.1000	0.0200	11/14/07	1710	GRP	58	73	39
✓		QC Services Audit 11/14/07											
✓	Y	129.9997	99.9997	10.0000	1.0000	0.1000	0.0200	11/15/07	1350	ATM	59	72	45
✓	N	129.9996	99.9996	9.9999	0.9999	0.1000	0.0200	11/16/07	1600	GRP	58	71	44
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	11/18/07	1758	ATM	60	74	43
✓	Y	129.9997	99.9997	10.0000	1.0001	0.1001	0.0200	11/19/07	1143	ATM	56	70	40
✓	Y	129.9995	99.9996	10.0000	1.0000	0.1000	0.0199	11/20/07	1416	GRP	54	69	35
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	11/27/07	1110	ATM	57	70	44
✓	N	129.9995	99.9996	10.0000	1.0000	0.1000	0.0199	12/3/07	0730	GRP	55	69	40
✓	N	129.9996	99.9996	10.0000	1.0000	0.0999	0.0200	12/6/07	1125	ATM	54	67	44
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/7/07	1348	GRP	55	69	40

ATM

WOODSTOVE DATA SHEET 4-4 SCALE QC RECORD SHEET

FROM: 12/8/07
THROUGH: 2/3/08

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

Level	Recalibrated	130 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/8	1215	ATM	57	73	35
✓	N	129.9996	99.9996	10.0000	1.0000	0.1001	0.0200	12/8	1910	ATM	57	72	38
✓	N	129.9997	99.9996	10.0000	1.0000	0.1000	0.0199	12/9	1935	ATM	55	72	31
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/10	1953	ATM	56	72	34
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/11	1618	GRP	57	76	28
✓	N	129.9997	99.9996	10.0000	1.0000	0.0999	0.0199	12/12	1505	GRP/ATM	56	74	30
✓	N	129.9996	99.9996	9.9999	0.9999	0.1000	0.0199	12/13	1307	GRP	55	73	29
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	12/14	1321	GRP	57	75	31
✓	N	129.9998	99.9998	9.9999	1.0001	0.1000	0.0199	12/15	1602	GRP	57	75	31
✓	Y	129.9996	99.9997	9.9999	1.0000	0.1000	0.0199	12/17	0817	GRP	55	73	29
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/18	0853	GRP	58	75	34
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/19	0812	GRP	55	72	31
✓	Y	129.9995	99.9996	10.0000	1.0001	0.0999	0.0199	12/20	0916	GRP	57	71	41
✓	Y	129.9998	99.9997	10.0000	1.0000	0.1000	0.0199	12/21	1085	ATM	55	70	36
✓	N	129.9997	99.9996	10.0000	1.0000	0.10000	0.0200	12/22	1434	[illegible]	54	66	44
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/23	0915	ATM	57	70	44
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	12/26	1230	ATM	57	70	44
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0210	12/27	1030	ATM	56	72	34
✓	N	129.9998	99.9997	9.9999	1.0000	0.1000	0.0200	1/8/08	1342	GRP	54	68	38
✓	N	129.9997	99.9997	10.0000	1.0001	0.1000	0.0200	1/9/08	0742	GRP	55	70	36
✓	N	129.9998	99.9998	10.0000	1.0000	0.1000	0.0199	1/11/08	1040	ATM	59	73	42
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1000	0.0199	1/16/08	1221	GRP	51	72	18
✓	N	129.9999	99.9998	10.0000	1.0000	0.1000	0.0199	1/17/08	1237	GRP	56	71	37
✓	N	129.9998	99.9998	10.0000	1.0000	0.0999	0.0200	1/18/08	1116	GRP	56	71	37
✓	Y	129.9995	99.9996	9.9999	1.0001	0.1000	0.0199	1/21/08	1426	GRP	56	72	34
✓	N	129.9995	99.9996	10.0000	1.0001	0.1000	0.0199	1/22/08	1513	GRP	56	71	37
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	1/23/08	0805	GRP	54	69	36
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	1/24/08	0758	GRP	54	70	33
✓	N	129.9998	99.9997	10.0000	1.0000	0.1000	0.0199	1/24/08	1450	GRP	56	71	37
✓	N	129.9997	99.9996	10.0000	1.0000	0.1000	0.0200	1/31/08	1505	GRP	55	69	38
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	2/1/08	1029	GRP	54	69	36
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	2/2/08	1620	ATM	58	72	41
✓	N	129.9996	99.9997	10.0000	1.0001	0.1000	0.0200	2/3/08	1710	ATM	57	70	44

WOODSTOVE DATA SHEET 4-4 ANALYTICAL BALANCE QC RECORD SHEET

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

FROM: 12/20/08
THROUGH: 2/17/09

Level	Recalibrated	140 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	12/20/08	1430	ADM	58	72	42
✓	N	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	12/23/08	1057	QRP	60	76	38
✓	N	139.9994	99.9994	9.9999	1.0001	0.1000	0.0200	12/24/08	1019	ATM	59	72	45
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0200	12/26/08	1142	ATM	59	72	45
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0200	12/28/08	1050	ATM	60	75	37
✓	N	139.9994	99.9994	10.0000	.9999	0.1000	0.0199	1/05/09	1157	PDG	58	75	34
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	1/6/09	1845	ATM	60	75	37
✓	N	139.9995	99.9996	9.9999	1.0000	0.1000	0.0199	1/7/09	1530	QRP	58	70	48
✓	N	139.9994	99.9994	9.9999	.9999	0.1000	0.0199	1/8/09	1356	PDG	60	72	49
✓	Yes	139.9993	99.9994	9.9999	1.0000	0.1000	0.0200	1/09/09	1053	PDG	58	72	42
✓	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	1/11/09	1128	JRP	55	72	31
✓	YES	139.9994	99.9995	9.9999	1.0000	0.1000	0.0199	1/12/09	0845	PDG	59	75	38
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0200	1/13/09	0825	JRP	58	74	37
✓	yes	139.9993	99.9994	9.9999	0.9999	0.1000	0.0199	1-14-09	1212	PDG	57	72	38
✓	NO	139.9993	99.9993	9.9999	1.0000	0.0999	0.0199	1/14/09	1420	QRP	59	75	37
✓	NO	139.9992	99.9993	10.0000	1.0000	0.0999	0.0199	1-15-09	1128	QRP	58	74	37
✓	yes	139.9994	99.9995	9.9999	0.9999	0.1000	0.0199	1-20-09	0950	PDG	58	74	37
✓	no	139.9993	99.9994	10.0000	0.9999	0.1000	0.0199	1-20-09	1230	PDG	56	71	37
✓	NO	139.9993	99.9993	9.9999	1.0000	0.0999	0.0199	1-20-09	1613	JRP	57	73	35
✓	No	139.9994	99.9994	9.9999	1.0000	0.1001	0.0200	1/22/09	1138	ATM	57	72	38
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	1/23/09	1150	PDG	58	75	33
✓	YES	139.9992	99.9993	10.0000	1.0000	0.0999	0.0200	1/26/09	1359	JRP	56	76	25
✓	no	139.9994	99.9995	10.0000	1.0000	0.1000	0.0199	1/27/09	1530	PDG	55	72	31
✓	No	139.9993	99.9993	10.0000	1.0001	0.1001	0.0200	1/28/09	1452	ATM	61	75	41
✓	YES	139.9993	99.9994	10.0000	1.0000	0.1000	0.0199	1-29-09	1436	QRP	58	77	29
✓	no	139.9995	99.9995	9.9999	0.9999	0.1000	0.0199	1/30/09	1256	PDG	60	72	49
✓	yes	139.9993	99.9994	9.9999	1.0000	0.1000	0.0199	2/1/09	1260	ATM	58	74	37
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	2/2/09	1350	QRP	58	77	29
✓	yes	139.9995	99.9996	9.9999	1.0000	0.1000	0.0199	2/5/09	1118	PDG	59	72	45
✓	NO	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	2/6/09	1150	QRP	57	74	33
✓	No	139.9994	99.9994	10.0000	1.0001	0.1000	0.0200	2/9/09	1015	ATM	49	70	19
✓	NO	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	2/16/09	1551	PDG	61	78	36
✓	NO	139.9993	99.9994	9.9999	1.0000	0.1000	0.0200	2/17/09	1439	JRP	56	72	35

WOODSTOVE DATA SHEET 4-4 ANALYTICAL BALANCE QC RECORD SHEET

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

FROM: 2/10/09
THROUGH:

Level	Recalibrated	140 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
Y	Y	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	2/10/09	1800	ATM	55	70	36
Y	Y	139.9993	99.9994	9.9999	1.0000	0.1000	0.0199	2-19-09	1248	JRP	56	73	32
Yes	Y	139.9993	99.9994	9.9999	0.9999	0.1000	0.0199	2/20/09	1018	PDG	57	74	33.
Yes	Y	139.9993	99.9994	10.0000	1.0000	0.1000	0.0200	2/21/09	1519	ATM	60	77	35
Yes	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	2/22/09	1222	ATM	47	59	37
~~Y~~	~~Yes~~	~~139.9994~~	~~99.9994~~	~~9.9999~~	~~0.9999~~	~~0.1000~~	~~0.0199~~	~~2/23/09~~	~~1406~~	~~PDG~~	~~58~~	~~70~~	~~48~~
Yes	No	139.9994	99.9994	9.9999	1.0000	0.1000	0.0200	2/24/09	0953	ATM	59	76	35
Yes	Yes	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	2/25/09	1123	PDG	60	76	38
Yes	Yes	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	2-26-09	1258	JRP	55	70	36
YES	YES	139.9993	99.9993	9.9999	1.0001	0.1001	0.0200	2/29/09	1330	ATM	57	74	33
Yes	Yes	139.9995	99.9995	9.9999	0.9999	0.1000	0.0199	3/3/09	1431	PDG	59	76	35
~~Yes~~	~~NO~~	~~139.9993~~	~~99.9995~~	~~9.9999~~	~~1.0000~~	~~0.1000~~	~~0.0199~~	~~3/4/09~~	~~1556~~	~~JRP~~	~~56~~	~~70~~	~~40~~
Yes	No	139.9994	99.9994	9.9999	1.0001	0.1001	0.0200	3/5/09	1350	ATM	60	75	40
Yes	No	139.9993	99.9993	9.9999	1.0000	0.1000	0.0200	3/7/09	0850	ATM	57	71	41
Yes	Yes	139.9993	99.9993	10.0000	1.0001	0.1000	0.0200	3/8/09	1323	ATM	55	70	36
Yes	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	3/10/09	1212	PDG	50	75	10

Woodstove Particulate
Catch Processing Sheet
Woodstove Data Sheet #5
EPA M5G-1

Unit: Kuma Ashwood
Run: EPA 6
Date: 2/27/09
Technicians: ATM
Revised 1/16/98-Data Sheet #5

Filters

Filter # (Front) 716 Beaker # 26 Final Wt. 71.7927 g
Final Wt. .6888 g Ml 55 Tare Wt. 71.7877 g
Tare Wt. .6690 g Desc. Acetone Net Wt. .0050 g
Net Wt. .0198 g

Filter # (Rear) 715 Beaker # ______ Final Wt. ______ g
Final Wt. .6750 g Ml ______ Tare Wt. ______ g
Tare Wt. .6744 g Desc. ______ Net Wt. ______ g
Net Wt. .0006 g

Acetone Blank Calculation: Blank Date: 12/8/07

Blank Beaker # 25 Final Wt. 72.6511 g
Ml 50 Tare Wt. 72.6512 g
Desc. Acetone Net Wt. -.0001 g = 0.0000
.0000 g ÷ 50 ml = .0000 g/ml

Blank Residue Value Calculation:

.0000 g/ml acetone X 55 ml acetone = .0000 g
Blank Residue Value

Total Particulate Catch Calculation

Filter: .0198 g
Filter: .0006 g
Beakers: .0050 g (Total Catch) - .0000 g (Blank Residue Value) = .0050 g
Total Catch = .0254 g

Unit Kuma Ashwood
Run # EPA 6
Date 2/27/09
Technician ASTM JTP PDG
WST6-Form1,Rev8/96

MISCELLANEOUS TEST DATA
WOODSTOVE DATA SHEET #8

Useable Firebox Dimensions: See QC Section Useable Volume: 2.094 ft^3

Dilution Tunnel Draft (If applicable): Start .000 Stop .000 "Hg

Test Chamber Air Velocity: Start: 00.0 Stop: 0.00 Avg: .000 ft/min

Wet Bulb/ Start: WB: 56 °F DB: 73 °F .95% Amb Moisture 32 %RH

Dry Bulb Stop: WB: 57 °F DB: 73 °F 1.05% Amb Moisture 35 %RH

$\bar{X}$ = 1.00 % Ambient Moisture $\bar{X}$ = 33.5 % Relative Humidity (RH)

Empty Stove Wt: 440.2 lbs.

Empty Stove Wt with Stack (Inc. Oil Seal) Wet: 765.5 lbs. Dry: 765.6 lbs. 767.6

Empty Stove Wt with Stack and Ash Ash: — lbs. Total: — lbs.

Kindling Wt. TOTAL 5.2 Paper: 0.4 lbs. Wood: 4.8 lbs.

Pre Burn Fuel Wt. 11.454 + 14.138 + 10.686 Total: 36.278 lbs.

Total Kindling and Pre Burn Fuel Wt 41.478 lbs.

Coal Bed Wt-lbs: Range(3.3 - 2.7) 768.9 - 768.3 lbs. Actual: 2.7 768.3 lbs.

Allowable Amount of Charcoal that can be removed:

Coal Bed Wt. Range 3.3 (Upper Wt.) + 2.5 (Lower Wt.) /2 X .25 = 0.7 lbs.

Test Fuel Wt-lbs: Ideal 14.7 lbs. Range: 16.1 - 13.2 lbs. Actual: 13.314 lbs.

Test Fuel Size (pcs.)(.75 x 1.5 x 5" Flanges) 1.888 lbs. 16 Pcs.

2 x 4's x 16.4375 " 3 Pcs 6.252 lbs. 46.96 %

4 x 4's x ↓ " 2 Pcs 7.062 lbs. 53.04 %

4.9966 Kg

Est. Dry Burn Rate (Kg/Hr.) $\frac{13.314 - (13.314 \times .172649)}{2.2046} \times \frac{60}{250}$ = 1.1992 Est. Dry Burn Rate (Kg/Hr)

Est EPA Heat Output(HO_E) (Avg BTU's/Hr) (19,140) X $\frac{63}{100}$ x 1.1992 = 14,460 Est Heat Output (HO_E) BTU's/Hr

Comments: 240 mins = 1.2491 Kg/hr.

Stove Operating Data
Woodstove Test Data Sheet #9
Cold Start

Unit: Kuma Ashwood
Run: EPA 6
Date: 2/27/09
Technician(s): AHM JRP PDG
Data Sheet#9–Rev 1/98-Pg.2

Fire Started: 10:03

Warm up and Preburn: Primary Air: Wide open from ignition until the start of preburn when the primary air control(s) was (were) adjusted to the run setting of 0.5235" open. At the run setting until the start of the test.
2.5" on Threaded Rod

Secondary Air: No Controls. Naturally drafted

Secondary Burn Bypass: N/A

Charcoal Bed Preparation: Broke up, raked and leveled the coal bed prior to the addition of each warm up/pre burn fuel charge. Starting 1:30 before the start of the test, broke up, raked and leveled the coal bed. In stove for 25 seconds.

Test: Door wide open during loading 1 min 1 sec, then closed

Primary Air: Wide open from the start of the test (0:00) until 4:45. Adjusted to the run setting of 0.5235" between 4:45 and 5:00. At the run setting of 0.5235" at 5:00 into the run.

Secondary Air: No Controls. Naturally Drafted.

Secondary Burn Bypass: N/A

Fan: ON/OFF during the warm up, ON/OFF Low during the preburn, ON/OFF at the start of test, ON/OFF for the first 30 minutes of test, ON/OFF Low at 30 minutes into test, ON/OFF for the rest of test.

Test Run Anomalies: Much better start than Run 5.

Unit Kumu Hsmme
Run # EPA 6
Date 2/27/09
Technician ATM JRP PDG
Page 1 of 4
WST7-Form2-A, Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-1

Wood Data: Kindling: A mix of the below grades

	Size	Mill	Grade	Species
Pre Burn	2X4	Forest Grove	#2 & BTR	D. Fir, Sfc Grn
Test Fuel	2X4	Forest Grove	#2 & BTR	D. Fir, Sfc. Grn
	4X4	Forest Grove	#1	D. Fir, Sfc Grn

All grades WCLB Rules unless otherwise noted.

Warm up Information:

1st Warm up/Pre Burn Fuel charge (11.454 lbs) added at 1020.
2nd Warm up/Pre Burn Fuel charge (14.138 lbs) added at 1115.
3rd Warm up/Pre Burn Fuel charge (10.686 lbs) added at 1216.
4th Warm up/Pre Burn Fuel charge (______ lbs) added at ______.
5th Warm up/Pre Burn Fuel charge (______ lbs) added at ______.
6th Warm up/Pre Burn Fuel charge (______ lbs) added at ______.
7th Warm up/Pre Burn Fuel charge (______ lbs) added at ______.
8th Warm up/Pre Burn Fuel charge (______ lbs) added at ______.

1st Rick 4-12", 4-16" 2x4's.
2nd Rick 8-16" 2x4's
3rd Rick 4-12", 3-16" 2x4's

The coals were scooped out of the stove immediately prior to adding the Third pre burn/warm up fuel charge. The stove lost 0 lbs. 0.0 lbs. of coals were put back in the stove after the scoop.

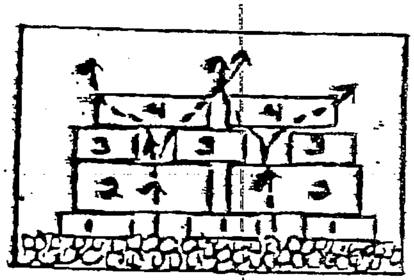
All pre burn/warm up fuel pieces were either 12 or 16 inches long. All preburn pieces/fuel charges were "ricked" in the stove. The pieces in the bottom layer in each rick contained 2 pcs that were 12 or 16 inches long and were loaded flat and perpendicular to the door. The pieces in the second layer in each rick were loaded on their side (edge) approximately parallel to the door and contained 3 or 4 pcs 16 inches long. The third layer (and fourth layer if present) was loaded flat, perpendicular to the door and contained 2 pcs 12 or 16 inches long. The majority of the pieces in each rick were in the second layer which had an approximate 0.5-1.0" space between pieces. (The loading directions indicate the direction of the longest dimension on each piece relative to the loading door opening.) Each pre burn/warm up fuel charge normally weighs within the weight range allowed for the actual test fuel charge

Unit Kuma 1450T Woodc
Run # EPA6
Date 2/27/09
Technician ATM JRP PDG
Page 2 of 4
WST7-Form2-A, Rev 6/90

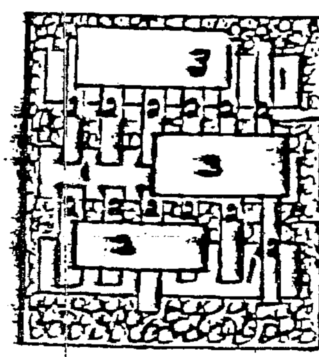
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-2

Warm up Information (cont.):

Each warm up/preburn fuel charge was ricked in exactly (as much as possible) the same manner and the weight of each rick was usually within the allowable weight range for the test fuel charge. The physical arrangement and alignment of each rick was designed to accomplish three (3) things: (1)The bottom layer was nestled firmly into the coal bed and was as close to being level with the bottom of the stove as possible, thus providing a stable loading platform for the rest of the rick, keeping it in a ricked state (as opposed to a col- lapsed or fallen down state) untill the rick reached the charcoal stage and sags or collapses of its own accord. (2) It enhances the flow of primary air through the ricked preburn fuel charge, for the primary air would flow through the spaces between the pieces in the first layer and then up through the spaces between the pieces in the second, third and, if present, fourth layers. (3) It maximized, as much as possible, the surface to volume ratio of each preburn fuel charge, thereby allowing the fire immediate access to as much wood surface as possible and, thereby, insuring uniform charcoalization. All three of these enhance combustion and so get the stove as hot as possible during the warm up period, therby maximizing the amount of heat (BTU's) stored in the stove. The actual preburn was not started until the stove surface temperatures had maximized and stabilized, thus indicating that the amount of heat stored in the stove had peaked. For this stove, the thermal storage was monitored using the Stove Top T/C surface temperature(s) and the peak value(s) obtained were 1062 °F. 1062



Front View



Top View

The arrows indicate the direction of the air flow through the rick.

The primary air was adjusted to the run setting of 0.5235" open 3.6 lbs above the upper charcoal bed weight.
2.500" on the threaded rod.

Unit Kuma Ashwood
Run # EPA 6
Date 2/17/09
Technician AVM JRP ADG
Page 3 of 4
WST5-Form2-Rev11/89

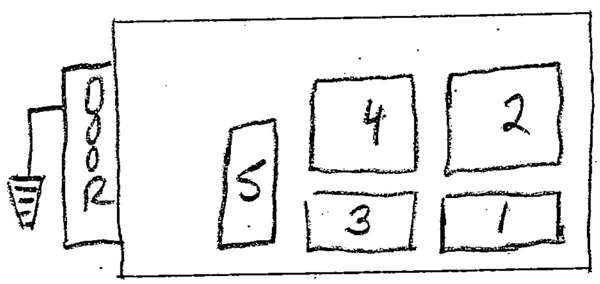
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-3

Additional Comments: Test Start Sequence: (1) Turned Fan OFF (2) Adjusted Primary Air Control to Wide Open (3) Opened door (4) Loaded Fuel Charge (5) Cleared coals away from in front of the LPAO (6) closed door

Total Elapsed Time: 1:00
Photo Taken @ ~ 2:30

Test Fuel Charge Loading Information:

Test Fuel Charge and Loading Sequence Diagram



Side of stove view

4 X 4's: 2, 4

2 X 4's: 1, 3 & 5

Loading Sequence: 1, 2, 3, 4 & 5 last

Driest Pcs in Load 3, 5

Loaded the test fuel charge on an essentially level, Medium sized, hot coal bed (in appearance, color and temperature for a Med Load (1.0-1.25) burn rate. Load: 1:01 Ignition: 1:00

1:01 VC (Vertical Column of flame) up to baffle.

1:10 Secondaries Igniting

2:30 Photo, Secondaries approximately full width of of Pc 4, Front Tube starting to ignite,

4:45-5:00 Primary Air Control (PAC) adjusted to run setting.

5:00 Flames decreasing. Maintained a hot pocket of coals under and behind pc 5 with a thin VC up to baffle w/ Secondaries at top and Sides of VC

6:05 13.1/1.44 (% CO_2 / %CO)

7:00 Big Pop, Blew a small piece of wood/charcoal

Unit Kuma Ashwood
Run # EPA 6
Date 2/27/09
Technician ATM JRP PDG
Page 4 of 4
WST5-Form2-Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-4

Additional Comments: (7:20 cont.) out of the bottom of pc 5. the VC is widening at base a little, still have secondaries
8:12 VC increasing
9:15 Medium (M) Smoke
10:38 7.0/1.04 M
11:14 Flames on the bottom edge of 5 left of center
12:39 Velocity in secondaries are lifting off the tube.
13:03 7.75/1.25 M
15:22 Secondaries full width of left end of pc 4, 8.8/1.30 MH
16:10 " forward past front tube in center
17:41 10:46/1.12 M/MH
18:04 Secondaries almost to right end of Pc 4
18:23 11.0/1.16. Flames on center top front edge of 5
18:42 Bal M/ML
19:15 Out 11.28/1.21
19:49 In Bal again 12.29/1.22 L/ML Front tube is igniting.
20:48 13.0/1.19 L
24:00 Lots of small pops
25:00 15.9/1.12 L/ML
30:00 Fan On Low 16.02/1.04

Unit: Kuma Ashwood
Run: EPA 6
Date: 2/17/09
Technician: ATM JRP RDG

FUEL MOISTURE
WOODSTOVE TEST DATA SHEET #10

WST1-Form7-Rev11/89

5 kg : 11.024 lbs 1 kg : 2.204 lbs.

Room Temperature: 61.1 °F   Correction Factor: 1.0

NOTE: Record readings to the nearest 0.5% moisture
Uncor Values are corrected for temperature: Yes ✓ No ____
Time Test Fuel Moisture Readings taken at: 10:50
Calibration Checks: X ____ Y ____ 12.0 11.8 22.0 22.0

	Pc #	Dimen	Use	Top Uncor	Top Cor	Bottom Uncor	Bottom Cor	Side Uncor	Side Cor	Piece Avg Corrected
	1	3 pcs	K	7.5	7.85	8.0	8.4	8.0	8.4	8.217
	2									
	3									
	4	2x4 - 8'	P	22	23.7	22	23.7	21	22.6	23.333
	5	↓	↓	18	19.2	19	20.3	19	20.3	19.933
	6			20	21.4	20	21.4	20.5	22.0	21.600
	7			19	20.3	19.5	20.9	19	20.3	20.500
	8			19.5	20.9	19.5	20.9	19	20.3	20.700
	9									106.066
	10									
	11									
1.408	12	2x4 -	T	19	20.3	19	20.3	19	20.3	20.300
1.898	13	↓	↓	21.5	23.1	21.5	23.1	21.5	23.1	23.100
1.592	14			19	20.3	19	20.3	19	20.3	20.300
	15									
3.044	16	4x4 -	T	17.5	18.6	20.5	22.0	18.5	19.8	20.133
3.476	17	↓	↓	19.5	20.9	19	20.3	19	20.3	20.500
	18									104.333
1.888	19	Spacers	T	19	20.3	19	20.3	18	19.2	19.933
	20								OUT	Spacers

	Kindling	Pretest Fuel	Test Load
% Moisture - Dry Basis:	8.217 %	21.2132 %	20.8666 %
% Moisture - Wet Basis:	7.593 %	17.501 %	17.2642 %

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

4x4
13.314 7.062

1 11.454
2 14.138
3 10.686

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

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

Unit: Kuma Ashwood
Run#: EPA 6
Date: 1/27/09
Technician: ASM JRP PDG

WOOD DENSITY DETERMINATION
WOODSTOVE TEST DATA SHEET #11

WST2-form11-Rev 6/90

2X4

Wood Piece: Nominal Dimensions: 3.5" x 3.5" x 1.5"

Depth (D): 3.875 cm

Width (W): 8.945 cm

Length (L): 9.005 cm
8.975 cm
9.000 cm
8.960 cm

Length $\bar{X}$ = 8.9850 cm

Volume: 311.437 cm^3
(D X W X L)

MOISTURE: Room Temperature: 61.1 °F Correction Factor: +1.0

Uncorrected Meter Readings Corrected for temperature: Yes ✓ No ___

NOTE: Record moisture meter readings to the nearest 0.5%

	Uncor	Cor
Top:	20	21.4 %
Bottom:	21.5	23.1 %
Side:	20	21.4 %
$\bar{X}$:		21.967 %

Avg % Moisture (Dry) 21.967 %

Aug % Moisture (Wet) 18.011 %

Scale: Leveled In ✓ Out ___

Zeroed: In ✓ Out ___

Wet Weight: 179.1 g Dry Weight: 146.5 g

% Moisture Dried Basis: 18.202 %
[1 - (Dry Wt ÷ Wet Wt)] X 100

	Date	Time	Temp
Into Dryer	2/27/09	1540	190 °F
Out of Dryer	4/2/09	1245	196 °F

(Minimum Time in Dryer: 24 hrs.) Minimum Dryer Temp 100°C (212°F)

Density = 146.5 g (dry wt) ÷ 311.437 cm^3 (volume) = 0.4704 g/cm^3

Pellet Fuel Moisture Content Determination

Tare Beaker Wt. ______ g

Wet Wt: ______ g - ______ g = ______ g
Gross Wet Wt. Tare Beaker Wt. Net Wet Wt.

Dry Wt: ______ g - ______ g = ______ g
Gross Dry Wt. Tare Beaker Wt. Net Dry Wt.

% Moisture Dried Basis: ______ %
[1 - (Net Dry Wt ÷ Net Wet Wt.)] X 100

Pre Burn Start WT.
3.6 lbs.l/p 772.5 lbs.
Test Start wt. Range
769.9 - 766.3 lbs.

PRE BURN DATA
RECORD SHEET #13
WST2-Form16

BARO. PRESSURE 28.75" Hg

Unit: KUMA ASHWOOD
Run: EPA6
Page: 1 of 1

Date: 2/27/09
Technician(s): ATM SRP
PDG

Hot Box On ✓

Minute	Time	Scale Weight	Burn Rate	T/C#-3 Stack	4 Stove Top	5 Left Side	6 Back	7 Right Side	8 Bottom	9 Firebox	10 2nd Burn	17	11 Room Temp	Static	Comments
															RAKE FWD @ 32 min
0	1235	772.5	0	513	972	581	409	580	360	1063	1404	1346	77	.075	Primary Air Set at 2.5" on T RC
5	40	771.7	.8	484	925	596	411	593	373	1018	1427	1374	77	.067	Secondary Air Set at
10	45	771.0	.7	465	887	604	410	596	382	1019	1362	1407	76	-.065	Fan: High @ load Low @ s/p
15	50	770.4	.6	451	874	607	412	596	387	1013	1413	1402	77	-.063	Tunnel on at: 1312
20	55	769.9	.5	414	842	611	413	602	388	1025	1318	1462	77	-.059	Buckets Iced ✓
25	1300	769.6	.3	377	771	616	415	602	387	1047	1376	1455	76	-.055	Analyzers Spanned
30	05	769.4	.2	345	712	611	421	595	386	1046	1245	1336	75	-.051	Pumps turned on at: 1333
35	10	769.1	.3	363	662	603	423	586	386	1027	1263	1176	75	-.052	532.0 ΔT ΔΔT
40	15	768.9	.2	322	640	582	415	570	386	959	1159	1058	76	-.048	518.6 -13.4
45	20	768.8	.1	306	606	565	406	584	385	927	1155	1076	76	-.045	Check WB/DB: 503.2 - 15.4
50	25	768.7	.1	292	572	549	396	536	384	893	1027	965	75	-.042	488.2 - 15.0
55	30	768.6	.1	262	544	535	389	522	383	867	961	944	76	-.041	474.6 - 13.6
		-												-	Probe In Tunnel ✓
60	1335	768.5	.1	275	520	522	379	507	381	844	968	912	76	-.040	Tunnel ΔP 461.8 - 12.8
65	40	768.4	.1	270	499	509	373	494	376	825	948	894	76	-.038	450.2 - 11.6
70	45	768.3	.1	247	484	496	370	463	374	816	939	886	76	-.038	441.8 - 8.4
75															
80															
85															
90															
															RAKE FWD @ FLAMEOUT
															440 lbs.

Myren Consulting Inc Data Sheet P1 of 3 Unit KOMA ASHWOOD Date 2 / 27 / 09 Run EKA6
Test En' Wt. 768.3 ΔT 441.6 Barometric Pressure 28.7 "hg Gas Flows @ 1.5" Technician(s) ATM JRD DI

Time E/T min	Time	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
0	1345	781.6	13.3	0	.1289	7.20		12.95	.150	1.50	4.6	Fan off				267	-.036
05	50	780.9	12.6	.7	.1283	7.05		13.41	.099	.99	7.9	M				450	-.060
10	55	780.5	12.2	.4	.1264	6.58		13.77	.111	1.11	5.9	"				324	-.048
15	1400	780.1	11.8	.4	.1289	7.20		13.10	.120	1.20	6.0	m-mH				304	-.048
20	05	779.5	11.2	.6	.1425	10.56		9.77	.115	1.15	9.2	m-mL				320	-.050
25	10	778.8	10.5	.7	.1583	14.46		5.91	.125	1.25	11.6	mL-L 19:48				358	-.053
30	15	778.2	9.9	.6	.1622	15.43		4.93	.100	1.08	14.3	L Fan on				363	-.056
35	20	777.5	9.2	.7	.1632	15.67		4.70	.106	1.06	14.8	L-W				395	-.057
40	25	776.9	8.6	.6	.1626	15.52		4.81	.113	1.13	13.7	wispy				397	-.057
45	30	776.3	8.0	.6	.1620	15.38		5.06	.092	.92	14.7	"				392	-.056
50	35	775.7	7.4	.6	.1630	15.62		4.94	.117	1.17	13.1	L-W 3:15 thru				395	-.057
55	40	775.1	6.8	.6	.1626	15.52		4.76	.123	1.23	12.6	" 5 is sagging				396	-.057
Tot																4381	.637

Time E/t	Time	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2^{nd} burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 #19	Tube 3 #20
0	1345	464	496	370	463	374	616	939	75	94	219	35	76	52	686			
05	50	477	463	374	466	373	705	1252	76	122	233	35	79	35	1100			
10	55	535	462	359	464	369	656	1036	76	101	241	34	60	35	1157			
15	1400	515	460	346	449	366	639	1196	76	97	231	35	79	35	1248			
20	05	521	462	333	442	362	659	1306	75	97	223	36	76	35	1320			
25	10	564	463	324	443	357	694	1317	75	98	224	37	76	35	1336			
30	15	631	467	315	447	351	737	1330	75	99	233	37	76	35	1303			
35	20	674	474	308	456	342	790	1370	76	100	236	37	76	35	1252			
40	25	700	463	300	460	335	820	1392	75	101	235	36	76	35	1220			
45	30	714	495	293	466	326	646	1386	76	100	231	36	76	35	1229			
50	35	727	507	286	472	323	883	1444	76	100	229	36	76	35	1276			
55	40	744	521	286	462	316	910	1331	76	100	229	39	79	35	1237			
Tot		7286	5803	3896	5532	4198	9155	15273	907									

Myren Consulting Inc Data Sheet P2 of 5 Unit KUMA ASHWOOD Date 2 / 27 / 09 Run EPA6

Test En ⁷/. 7683 AT 441.8 Barometric Pressure 26.9 "hg Gas Flows @ 1.5" Technician(s) ATM JRP)6

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
60	1445	774.5	6.2	.6	.616	15.28		4.99	.126	.126	12.1	L-W				395	-.057
65	50	773.9	5.6	.6	.644	15.97		4.26	.134	.134	11.9	wispy				396	-.057
70	55	773.3	5.0	.6	.611	15.15		5.13	.123	.123	12.3	L-W				367	-.056
75	1500	772.9	4.6	.4	.589	14.61		5.73	.113	.113	12.9	"				375	-.055
80	05	772.4	4.1	.5	.579	14.36		6.04	.100	.100	14.4	"				366	-.053
85	10	771.9	3.6	.5	.591	14.66		5.73	.103	.103	14.2	"				364	-.053
90	15	771.5	3.2	.4	.589	14.61		5.78	.102	.102	14.3	"				357	-.052
95	20	771.1	2.8	.4	.516	12.81		7.58	.102	.102	12.6	light Change of scale 1.5 thru	W/B			337	-.050
100	25	771.0	2.7	.1	.431	10.71		9.69	.101	.101	10.6	wisps				316	-.046
105	30	770.8	2.5	.2	.370	9.20		11.22	.096	.96	9.6	Clear				297	-.044
110	35	770.7	2.4	.1	.354	8.80		11.57	.106	.106	8.3	"				285	-.042
115	40	770.6	2.3	.1	.341	8.48		11.92	.099	.99	8.6	"				277	-.040
Tot																4152	.605

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2nd burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 #19	Tube 3 #20
60	1445	743	527	266	486	315	920	1347	76	99	230	39	76	35	1259			
65	50	752	534	295	469	312	937	1334	75	99	231	39	76	35	1315			
70	55	741	541	304	492	310	936	1343	75	99	231	39	76	35	1358			
75	1500	726	547	321	495	306	939	1339	75	98	230	39	76	35	1360			
80	05	711	551	337	497	307	933	1332	75	97	228	39	76	35	1404			
85	10	700	556	352	501	306	942	1337	74	97	227	37	76	35	1423			
90	15	697	560	363	503	304	958	1337	74	95	224	36	77	35	1441			
95	20	678	567	371	509	304	927	1253	74	95	226	36	77	35	1447			
100	25	651	560	362	510	304	900	1131	74	94	226	36	77	36	1297			
105	30	613	549	365	508	304	883	1098	74	92	226	36	77	36	1267			
110	35	577	537	394	502	304	670	1060	73	91	221	37	77	36	1166			
115	40	550	527	387	499	304	657	1015	74	91	219	37	77	36	1139			
Tot		8141	6556	4177	5991	3682	10002	14926	892									

Myren Consulting Inc Data Sheet P3 of 5 Unit Kuma Ash-[illegible] Date 2/27/09 Run 7946

Test End Wt. 766.3 ΔT 441.8 Barometric Pressure 28.7 "hg Gas Flows @ 1.5" Technician(s) ATM DRD

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
120	1545	770.5	2.2	.1	.333	8.28		12.03	.116	1.16	7.0	clear				270	-.039
125	50	770.4	2.1	.1	.333	8.26		11.95	.134	1.34	4.2					264	-.036
130	55	770.3	2.0	.1	.323	8.04		12.09	.154	1.54	5.2	"				257	-.036
135	1600	770.2	1.9	.1	.315	7.84		12.25	.163	1.63	4.6					250	-.036
140	05	770.1	1.8	.1	.314	7.81		12.26	.162	1.62	4.6					246	-.035
145	10	770.0	1.7	.1	.312	7.76		12.33	.162	1.62	4.8					243	-.034
150	15	769.9	1.6	.1	.296	7.37		12.58	.191	1.91	3.9	"				241	-.034
155	20	769.8	1.5	.1	.286	7.12		12.75	.205	2.05	3.5					238	-.034
160	25	769.7	1.4	.1	.275	6.85		12.99	.212	2.12	3.2					236	-.033
165	30	769.6	1.3	.1	.274	6.83		13.00	.215	2.15	3.2					233	-.033
170	35	769.6	1.3	0	.274	6.83		13.02	.211	2.11	3.2					231	-.032
175	40	769.5	1.2	.1	.278	6.92		12.95	.206	2.06	3.4					229	-.032
Tot																2940	.416

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2nd burn #10	Amb. #11	Tnl. #12	C Gas H.Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 ΔT #19	Tube 3 ΔT #20
120	1545	526	517	380	494	304	846	992	75	91	222	37	77	36	1102			
125	50	506	509	387	488	304	838	972	75	92	226	36	77	36	1075			
130	55	489	501	367	483	304	824	958	75	92	226	36	77	36	1052		432.8	-9.0
135	1600	473	493	364	477	303	806	946	74	91	227	35	77	35	1030			
140	05	463	487	362	472	302	995	927	74	90	226	35	77	35	990			
145	10	452	479	379	467	302	779	906	74	90	224	34	77	35	958		415.8	-26.0
150	15	444	495	376	464	303	774	694	75	91	226	35	76	36	944			
155	20	435	466	324	458	301	762	673	75	89	226	35	76	35	930		407.2	-34.6
160	25	426	464	322	454	302	751	653	75	90	227	35	76	36	905			
165	30	420	458	368	446	301	736	641	75	90	225	36	76	36	693		399.0	-42.8
170	35	413	452	366	444	299	726	636	76	91	224	36	76	36	693			
175	40	408	446	365	440	299	719	631	76	91	222	36	79	36	690		392.0	-49.8
Tot		5457	5751	4530	5589	3624	9362	10829	894									

Myren Consulting Inc Data Sheet P4 of 5 Unit Kuma Ashwood Date 2 / 27 / 00 Run 5PA6
Test End Wt. 768.13 ΔT 441.9 Barometric Pressure 26.73 "hg Gas Flows @ 1.5" Technician(s) ATM JRP

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
180	1645	769.4	1.1	.1	.273	6.80		13.08	.203	2.03	3.4	clear				228	-.031
185	50	769.3	1.0	.1	.271	6.75		13.14	.202	2.02	3.3					225	-.031
190	55	769.2	.9	.1	.265	6.60		13.28	.204	2.04	3.2					224	-.030
195	1700	769.2	.9	0	.262	6.53		13.28	.216	2.16	3.0					221	-.030
200	05	769.1	.8	.1	.260	6.48		13.32	.221	2.21	2.9					220	-.030
205	10	769.0	.7	.1	.254	6.33		13.45	.223	2.23	2.8	wood fell 3 burn-down				218	-.029
210	15	768.9	.6	.1	.275	6.85		13.13	.164	1.64	3.7					216	-.029
215	20	768.8	.5	.1	.261	6.50		13.28	.223	2.23	2.9					216	-.029
220	25	768.7	.4	.1	.257	6.41		13.36	.224	2.26	2.8					214	-.028
225	30	768.7	.4	0	.262	6.53		13.38	.198	1.98	3.3	pc of wood fell - blocking				214	-.029
230	35	768.6	.3	.1	.243	6.06		13.80	.208	2.08	2.9					213	-.029
235	40	768.5	.2	.1	.245	6.11		13.70	.218	2.18	2.8					212	-.029
Tot																2621	.354

E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2nd burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 ΔT #19	Tube 3 ΔΔT #20
180	1645	403	443	365	436	297	706	820	76	91	222	36	79	36	887			
185	50	397	438	366	431	296	694	807	76	90	222	36	79	36	873		385.6	-56.2
190	55	393	433	367	428	295	685	796	76	90	222	36	79	36	861			
195	1700	388	429	366	425	293	676	792	76	90	222	36	79	36	866		380.6	-61.2
200	05	383	424	370	421	291	670	787	76	89	222	36	79	36	855			
205	10	379	420	370	418	289	662	775	76	89	222	36	78	36	843		375.2	-66.6
210	15	375	417	368	415	288	672	793	76	89	222	36	78	36	899			
215	20	372	416	365	412	287	681	793	75	89	221	36	78	36	899		370.4	-71.4
220	25	370	415	362	410	285	682	786	75	88	222	36	79	36	873			
225	30	366	413	356	407	284	665	789	75	88	223	36	78	36	817		365.6	-76.2
230	35	367	411	353	406	283	667	764	75	88	223	36	78	36	787			
235	40	365	407	349	404	283	659	765	75	88	223	36	78	36	776		361.6	-80.2
Tot		4560	5066	4359	5013	3471	8139	9467	907									

Myren Consulting Inc Data Sheet P5 of 5 Unit Kuma Ashwood Date 2 / 27 / 09 Run EPA 6

Test End 768.3 ΔT 441.8 Barometric Pressure 28.725)"hg Gas Flows @ 1.5" Technician(s) ATM JRP DO

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
240	1745	768.4	.1	.1	.244	6.08		13.77	.209	2.09	2.9					211	-.028
245	50	766.4	.1	0	.240	5.99		13.93	.216	2.16	2.8					210	-.028
250	55	768.3	0	.1	.236	5.89		13.94	.214	2.14	2.6					206	-.026
255																629	.084
260														Total		14723	2.096
265														AVG	÷51	289	.041
270																	
275																	
280																	
285																	
290																	
295																	
Tot																	

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2nd burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent 2nd #17	Tube 1 #18	~~Tube 2~~ ΔT #19	Tube 3 ΔT #20
240	1745	362	402	345	403	282	651	767	74	67	223	36	76	36	770			
245	50	360	396	341	402	261	646	762	74	66	223	36	76	36	762		35[illegible].4	-85.4
250	55	358	393	339	402	260	637	754	74	66	221	36	77	36	764		350.4	-91.4
255		1080	1193	1025	1207	843	1934	2283	222									
260		26521	24369	17984	23333	15818	39592	52778	3828	Total								
265		520	478	353	457	310	776	1035	75	AVG	÷	51			Delta	T		
270															Start	441.8		
275															Stop	350.4		
280															ΔT	-91.4		
285																		
290																		
295																		
Tot																		

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-1

Site: Myren Consulting, ~~Woodinville~~, Colville WA Date: 2/27/09 Analyte: CO_2

Source: Kuma Ashwood Run #: EPA 6

Zero Cyl #: TC3AAM154 Conc. 00.0 % CO_2 Cyl Press: 1490 psi

Certified by: Oxarc Date: 11/12/07

Span Cyl #: AS90457 Conc. 12.5 % CO_2 Cyl Press: 1460 psi

Certified by: Matheson Tri Gas Date: 2/2/09

Analyzer: Make: Horiba Model: PIR-2000 SN: 607024

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

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter: ____

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

Pre Run Audit: By: A.T. Myren Time: 1255 Temp: 74 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.000	.05453	+0.05453	+0.22
Span	50.0	.500	12.5	50.0	.499	12.386	-0.1142	-0.91

Comments:

Post Run Audit: By: A.T. Myren Time: 1843 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	.07925	+0.07925	+0.32
Span	50.0	.500	12.5	50.0	.500	12.4105	-0.08953	-0.72

Comments:

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

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

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

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-3

Site: Myren Consulting, ~~Woodinville~~ Colville, WA Date: 2/27/09 Analyte: CO

Source: Kuma Ashwood Run #: EPA 6

Zero Cyl #: TC 3AAM154 Conc. 00.0 % CO Cyl Press: 1490 psi

Certified by: Oxarc Date: 11/12/07

Span Cyl #: AS 90457 Conc. 20 % CO Cyl Press: 1460 psi

Certified by: Matheson Tri Gas Date: 2/2/09

Analyzer: Make: ~~Infrared~~ HORIBA Model: ~~702~~ MEXA 311-GE SN: ~~[illegible]~~ GE-30075

Range: 0 - 10.0% CO Analyzer Output: 0 - ~~[illegible]~~ 1.0 V

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 5.0% CO
EPA Control Limits = +2.5% of 5.0% CO = + 0.125% CO

Pre Run Audit: By: A. T. Myren Time: 1255 Temp: 74 °F

Audit Results

Point #	Expected Response Meter	Expected Response DVM	Expected Response %	Actual Response Meter	Actual Response DVM	Actual Response %	± Conc. Difference	Δ %
Zero	00.0	00.0	00.0	00.0	.000	-.00443	-0.00443	-0.04
Span	2.00	.200	2.00	2.00	.199	1.9959	-0.0041	-0.21

Comments:

Post Run Audit: By: A. T. Myren Time: 1835 Temp.: 73 °F

Audit Results

Point #	Expected Response Meter	Expected Response DVM	Expected Response %	Actual Response Meter	Actual Response DVM	Actual Response %	± Conc. Difference	Δ %
Zero	00.0	00.0	00.0	0.00	.000	-.00443	-0.00443	-0.04
Span	2.00	.200	2.00	1.98	.198	1.9858	-0.01416	-0.71

Comments:

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

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

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

Unit: Kuma Ashwood
Run: EPA 6
Date: 2/27/09
Technicians: ATM JRP PDG
WST6-Form3-Rev11/89

QUALITY CHECKS
WOODSTOVE DATA SHEET #16

Ambient = Tr: ______ °F T/C#30: ______ °F

Thermocouple Check (at ambient): T/C#1: — °F; T/C#2: 69.0 °F;

T/C #3: 68.0 °F;	T/C #4: 60.2 °F;	T/C #5: 60.8 °F;
T/C #6: 60.0 °F;	T/C #7: 59.5 °F;	T/C #8: 60.3 °F;
T/C #9: 60.1 °F;	T/C #10: 62.2 °F;	T/C #11: 61.1 °F;
T/C #12: ______ °F;	T/C #13: 60.9 °F;	T/C #14: 57.2 °F;
T/C #15: 62.2 °F;	T/C #16: 60.0 °F;	T/C #17: 61.6 °F;
T/C #18: — °F;	T/C #19: ______ °F;	T/C #20: ______ °F;
T/C #21: ______ °F;	T/C #22: ______ °F;	T/C #23: ______ °F;
T/C #24: ______ °F;	T/C #25: ______ °F;	T/C #26: ______ °F;

Comments: ______

Thermocouple Readout: Pretest Zero/Span Check and Calibration:

		Post Test Check	% Difference
Zero (°F): −0.2 °F	Adj to: — °F	Zero (0°F): 0.9 °F	+0.20
Span (2000°F): 1999.9 °F	Adj to: — °F	Span (2000°F): 2002.3 °F	+0.01

(Allowable % Difference = 1.5%. Use formulas on Woodstove Data Sheet #15 to calculate % Difference) In degrees Absolute.

Thermocouple Readout Pretest Linearity Check

0°F = −0.2 °F;	200°F = 201.6 °F;	400°F = 399.0 °F;
600°F = 601.3 °F;	800°F = 801.5 °F;	1000°F = 1000.7 °F;
1200°F = 1198.4 °F;	1400°F = 1399.4 °F;	1600°F = 1599.8 °F
1800°F = 1800.0 °F;	2000°F = 1999.9 °F	

Combustion Gas (CO_2, O_2, CO) Train Leak Check: Pre ✓ OK PDG Post ✓ OK PDG

Draft (Static) Guage Zero Check: Pre ATM OK Post ✓ OK PDG

Scale Check Pre (Wt, #'s): 770.5/765.5 = 5.0 lbs /5.0 lbs = Ok ATM
Post (Wt, #'s): 773.9/768.9 = 5.0 lbs /5.0 lbs = OK PDG

Stack cleaned prior to the run: Yes ______ No ✓

Tunnel cleaned prior to the run: Yes ______ No ✓

EPA 7

MYREN CONSULTING CERTIFICATION TEST DATA

DILUTION TUNNEL CALCULATIONS

1\25\09, Md=28.56, Bws=4%

	6" Tunnel
File Name:	EPA 7
Manufacturer:	KUMA
Model Number:	ASHWOOD
Lab Name:	MYREN
Test Date:	3\2\09
Run Number:	EPA 7
Meter Box Y Factor:	1.0177
Barometric pressure (in):	28.138
Gas meter temp (ave):	**87**
delta H(avg):	**0.900**
Gas meter initial reading:	735.3000
Gas meter final reading:	887.7790
Front catch (acetone) mg:	10.8
first filter catch (mg):	24.8
second filter catch (mg):	-6.6
Tunnel Flow (Qsd) (dscfm)	**139.323**
Emission Rate(g/hr):	**1.719**
Emission Rate(M5H) :	**2.853**
Avg. of Delta P Sq. Roots:	**0.2012**
Vs (Avg.)(ft/min):	**824.439**
Tunnel Avg. Temperature (F):	**93.500**
Test time(min):	285
Fuel Load(lb. wet):	13.330
Wood moisture(%wet):	16.838
Burn rate(dry kg/hr):	**1.059**
Sample Volume (dscf)	**141.021**
Avg. Tunnel Static (-inch H2O):	**0.1544**
Room Blank Catch (mg/dscf):	0
Emission Factor (g/kg):	**1.6239**
Pitot Correction Factor:	0.97195
front filter number	718
back filter number	717
Beaker Number:	27
PRELIMINARY RESULTS	
FINAL RESULTS:	AUDITED
DATA SUMMARY	
MODEL:	ASHWOOD
RUN:	EPA 7
DATE:	3\2\09
DBR:	1.059
EMISSION RATE (g/hr)(M5H)	2.8534
EMISSION FACTOR (g/kg):	1.6239
AVG. % PROPORTIONALITY :	97.453

RUN TIME (min)	PITOT DELTAP (- INCH H20)	TNL TEMP (°F)	GAS METER RDG (ft3)	GAS METER TEMP (°F)	GAS METER DELTA H (in.H2O)	TUNNEL VELOCITY (ft/min)	PROP RATE (%)	dDGM vol std (ft3)	Tunnel Static (- Inch H2O)	SQUARE ROOT DELTA P	DRY GAS METER RDG (m3)
0	0.041	95	735.3000	69	0.900	854.68			0.160	0.2025	
10	0.042	101	740.6540	72	0.900	869.71	101.8	5.096	0.163	0.2049	
20	0.043	96	745.9640	75	0.900	876.08	98.2	5.025	0.167	0.2074	
30	0.040	97	751.3800	79	0.900	845.71	102.5	5.088	0.153	0.2000	
40	0.040	99	756.6810	82	0.900	847.23	99.3	4.952	0.153	0.2000	
50	0.039	100	761.8460	84	0.900	837.31	97.4	4.807	0.144	0.1975	
60	0.041	99	767.7670	86	0.900	857.75	108.0	5.491	0.150	0.2025	
70	0.040	98	772.5000	88	0.900	846.47	86.7	4.373	0.152	0.2000	
80	0.040	97	777.8390	88	0.900	845.71	97.7	4.933	0.151	0.2000	
90	0.040	97	783.1730	89	0.900	845.71	97.3	4.919	0.153	0.2000	
100	0.040	97	788.5270	89	0.900	845.71	97.6	4.938	0.153	0.2000	
110	0.040	96	793.8720	90	0.900	844.95	97.0	4.921	0.154	0.2000	
120	0.040	94	799.2370	90	0.900	843.43	97.2	4.939	0.153	0.2000	
130	0.040	92	804.5940	90	0.900	841.90	96.9	4.932	0.153	0.2000	
140	0.039	91	809.9620	90	0.900	830.56	98.2	4.942	0.150	0.1975	
150	0.039	91	815.3390	90	0.900	830.56	98.4	4.950	0.153	0.1975	
160	0.040	91	820.7090	90	0.900	841.14	97.0	4.944	0.154	0.2000	
170	0.040	91	826.0750	91	0.900	841.14	96.6	4.931	0.155	0.2000	
180	0.040	91	831.4540	91	0.900	841.14	96.8	4.943	0.154	0.2000	
190	0.040	90	836.8340	91	0.900	840.38	96.8	4.944	0.153	0.2000	
200	0.040	91	842.2120	91	0.900	841.14	96.8	4.942	0.155	0.2000	
210	0.040	91	847.5900	91	0.900	841.14	96.8	4.942	0.154	0.2000	
220	0.040	91	852.9670	91	0.900	841.14	96.8	4.941	0.154	0.2000	
230	0.040	91	858.3480	91	0.900	841.14	96.9	4.945	0.155	0.2000	
240	0.040	91	863.7200	91	0.900	841.14	96.7	4.936	0.156	0.2000	
250	0.040	90	869.0700	91	0.900	840.38	96.2	4.916	0.157	0.2000	
260	0.040	90	874.4100	91	0.900	840.38	96.1	4.907	0.155	0.2000	
270	0.040	90	879.7630	91	0.900	840.38	96.3	4.919	0.156	0.2000	
280	0.040	89	885.1100	91	0.900	839.61	96.1	4.913	0.155	0.2000	
285	0.040	88	887.7790	91	0.900	838.85	95.8	2.453	0.157	0.2000	
			0.0000			0.00	0.0	0.000			
310			0.0000			0.00	0.0	0.000			
320			0.0000			0.00	0.0	0.000			
330			0.0000			0.00	0.0	0.000			
340			0.0000			0.00	0.0	0.000			
350			0.0000			0.00	0.0	0.000			
360			0.0000			0.00	0.0	0.000			
370			0.0000			0.00	0.0	0.000			
380			0.0000			0.00	0.0	0.000			

13.33
16.838

METHOD 5G -1 EPA **PARTICULATE SAMPLING DATA** **Rev. 2/09**

DATE: 3/2/09 **PAGE** 1 **OF** 2 **UNIT:** Kuma Ashwood **RUN:** EPA 7

METER BOX: 45G-P **METER Y:** 1.0177 **FILTER #'S: (F)** 718 **(R)** 717

.015/.015
PRE TEST LEAK CHECK: .000 **CFM @** -15.75 **IN HG** **FILTER SIZE:** 110 **mm**

.843/.843
POST TEST LEAK CHECK: .000 **CFM @** -15.8 **IN HG** **PROBE LENGTH** 21.0 **IN**

TIME		METER READING	PITOT		TUNNEL TEMP	METER TEMP	GAS METER	VAC
CLOCK	ELAPSED	(FT³)	ΔP	Pg	(°F)	(°F)	Δh	(in Hg)
1355	00	735.300	.041	-.160	95	69	0.90	0
1405	10	740.654	.042	-.163	101	72	.90	0
15	20	746.964	.043	-.167	96	75	.90	0
25	30	751.380	.040	-.153	97	79	.90	0
35	40	756.681	.040	-.153	99	82	.90	0
45	50	761.846	.039	-.144	100	84	.90	0
55	60	767.767	.041	-.150	99	86	.90	0
1505	70	772.500	.040	-.152	98	88	.90	0
15	80	777.839	.040	-.151	97	88	.90	0
25	90	783.173	.040	-.153	97	89	.90	0
35	100	788.527	.040	-.153	97	89	.90	0
45	10	793.872	.040	-.154	96	90	.90	0
55	120	799.237	.040	-.153	94	90	.90	0
1605	30	804.594	.040	-.153	92	90	.90	0
15	40	809.962	.039	-.150	91	90	.90	0
25	50	815.339	.039	-.153	91	90	.90	0
35	60	820.709	.040	-.154	91	90	.90	0
45	70	826.075	.040	-.155	91	91	.90	0
55	180	831.454	.040	-.154	91	91	.90	0
1705	90	836.834	.040	-.153	90	91	.90	0

BP

00	28.16	215	28.12
60	28.14		
120	28.15		
180	28.14		
240	28.12	AVG. =	28.138

Pre Test Filter Check Weighing
F .6729
R .6539

End of Test Weight
F .6985 R .6438
.6723 .6536
.0262

METHOD 5G -1 EPA **PARTICULATE SAMPLING DATA** **Rev. 2/09**

DATE: 3/2/09 **PAGE** 2 **OF** 2 **UNIT:** KUMA ASHWOOD **RUN:** EPA 7

METER BOX: 450-P **METER Y:** 1.0177 **FILTER #'S: (F)** 718 **(R)** 717

.015 / .015

PRE TEST LEAK CHECK: .000 **CFM @** -15.75 **IN HG FILTER SIZE:** 110 **mm**

.843 / .843

POST TEST LEAK CHECK: .000 **CFM @** -15.8 **IN HG PROBE LENGTH** 21.4 **IN**

TIME		METER READING	PITOT		TUNNEL TEMP	METER TEMP	GAS METER	VAC
CLOCK	ELAPSED	(FT³)	ΔP	Pg	(°F)	(°F)	Δh	(in Hg)
1715	2 00	842.212	.040	-.155	91	91	.90	0
25	10	847.590	.040	-.154	91	91	.90	0
35	20	852.967	.040	-.154	91	91	.90	0
45	30	858.348	.040	-.155	91	91	.90	0
55	240	863.720	.040	-.156	91	91	.90	0
1805	50	869.070	.040	-.157	90	91	.90	0
15	60	874.410	.040	-.155	90	91	.90	0
25	70	879.763	.040	-.156	90	91	.90	0
35	80	885.110	.040	-.155	89	91	.90	0
40	~~90~~ 285	887.779	.040	-.157	88	91	.90	0
	00							
	10							
	20							
	30							
	40							
	50							
	60							
	70							
	80							
	90							

BP

00	28.16	285	28.12
60	28.14		
120	28.15		
180	28.14		
240	28.12	AVG. =	28.138

Pre Test Filter Check Weighing
F .6729
R .6539

End of Test Weight
F .6723 R .6536

MYREN CONSULTING, INC.
Dilution Tunnel Traverse Data with 8 Traverse Points

Unit: Kuma Ashwood
Run #: EPA 7
Date: 3-2-09
Technicians: ATM GRP PDG
Rev 2/16/09

Point	Location	Δp	$\sqrt{\Delta p_{trav}}$	Δp	$\sqrt{\Delta p_{cent}}$	#12 T_{trav}	#12 T_{cent}	Pg
W-1	0.5"	.036	.1897			105		
2	1.5	.040	.2000			99		
Center	Center			.041	.2025		99	-.155
3	4.5	.040	.2000			99		
4	5.5	.039	.1975			99		
S-1	0.5	.034	.1844			102		
2	1.5	.039	.1975			101		
Center	Center			.040	.2000		100	-.154
3	4.5	.040	.2000			99		
4	5.5	.038	.1949			99		
	Totals		1.5640		.4025	803	199	-.309
	Average		.1955		.2013	100.375	99.5	-.1545
	°R = (°F + 460)					560.375	559.5	

Ps = BP + (-Pg/13.6) = 28.175 + (-.1545/13.6) = 28.164 "Hg

LEAK CHECKS:
Pre Test: Pg Leg: OK GRP Velocity Head Leg: OK GRP
Post Test: Pg Leg: OK PDG Velocity Head Leg: OK PDG

DILUTION TUNNEL GAS VELOCITY & VOLUMETRIC FLOW RATE CALCULATIONS Rev 4/19/08

UNIT: Kuma Ashwood DATE: 3/2/09 RUN #: EPA-7 TECHNICIAN(S): ATM JRP PDE

Average Gas Velocity in the Dilution Tunnel Vstrav (EPA M2 EQN 2-9, ASTM E 2515-07 EQN 7)

(9) Vstrav = (85.49)(0.99 cp) (.1955 $\overline{x}$ $\sqrt{\Delta P}$ "H_2O) $\sqrt{\dfrac{560.375 \text{ Ts °A } \{0\}}{(28.164 \text{ Ps "Hg}) \{2\} \ (28.56 \text{ lb./ lb. mole})}}$ = 13.81053 fps {2}

{2} {2}

(9A) Vs = (13.81053 fps)(60) = 838.632 fpm
{2} {2}

Gas Velocity in the Center of the Dilution Tunnel - Vscent (EPA M2 EQN 2-9, ASTM E 2515-07 EQN 7)

(9) Vscent = (85.49)(0.99 cp) (.2013 $\overline{x}$ $\sqrt{\Delta P}$ "H_2O) $\sqrt{\dfrac{559.5 \text{ Ts °A } \{0\}}{(28.164 \text{ Ps "Hg}) \{2\} \ (28.56 \text{ lb./ lb. mole})}}$ = 14.20915 fps {2}

{2} {2}

(9A) Vs = (14.20915 fps)(60) = 852.549 fpm
{2} {2}

EPA M5G1 Section 4.2.2, ASTM E 2515-07 EQN 1 Adjustment Factor for Center of Tunnel Pitot Tube Location

Fp = Vstrav/ Vscent = 13.81053 ÷ 14.20915 = .97195

Average Stack Gas Dry Volumetric Flow Rate - Qsd (EPA M2 EQN 2-10, ASTM E 2515-07 EQN 3)

(10) Qsd = 3600(1 - 0.04 Bws)(13.81053 fps) {2} (.1963 ft^2) {3} [(528 °A)(28.164 Ps "Hg) {2} / (560.375 T_s °A) {0} (29.92" Hg) =
8309.833 dscfhr (or dscfh)
{1}

(10A) 8309.833 dscfhr ÷ 60 = 138.497 dscfmin (or dscfm)
{1} {1}

Note: Number in { } under blank lines denotes number of decimals to be used. If a blank calls for an answer already calculated, use the number of decimals previously specified for that answer.

WST5-Form9,Pg2,Rev1/90

WOODSTOVE DATA SHEET #4-1: INITIAL FILTER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date 1-20-09 Time 1149 By PDG Front Half X Back Half X

Manufacturer: Pall P/N. 60115 Size: 110 Lot.No.: 70726 Grade: A/E Glass

Filter #	First Wt	2009 Date	Time	By	Second Wt	Date	Time	By	Third Wt	2009 Date	Time	By
700	.6873	1-22	1331	GRP	.6877	1-23	1417	PDG				
701	.6871		1330	GRP	.6878		1419	PDG	.6877	1.26	1421	GRP
702	.6816		1329	GRP	.6825		1420	PDG	.6824	1.26	1420	GRP
703	.6761		1328	GRP	.6762		1421	PDG				
704	.6727		1327	GRP	.6732		1422	PDG				
705	.6833		1326	GRP	.6837		1423	PDG				
706	.6946		1325	GRP	.6948		1424	PDG				
707	.6773		1324	GRP	.6777		1425	PDG				
708	.6701		1323	GRP	.6702		1426	PDG				
709	.6799		1322	GRP	.6809		1427	PDG	.6806	1.26	1419	GRP
710	.6587		1321	GRP	.6590		1428	PDG				
711	.6654		1320	GRP	.6656		1429	PDG				
712	.6688		1319	GRP	.6692		1430	PDG				
713	.6864		1318	GRP	.6866		1431	PDG				
714	.6651		1318	GRP	.6655		1432	PDG				
715	.6741		1317	GRP	.6744		1433	PDG				
716	.6692		1316	GRP	.6690		1434	PDG				
717	.6531		1315	GRP	.6536		1435	PDG				
718	.6721		1314	GRP	.6723		1436	PDG				
719	.6769		1313	GRP	.6769		1437	PDG				
720	.6627		1312	GRP	.6628		1438	PDG				
721	.6567		1311	GRP	.6569		1439	PDG				
722	.6539		1310	GRP	.65340		1440	PDG				
723	.6552		1309	GRP	.6552		1441	PDG				
724	.6655		1308	GRP	.6656		1442	PDG				

Checked by A.T. Myers Date: 1/27/09 Time 1632

QA REWEIGH

Filter #	WT	Date	Time	By
703	.6761	1/27/09	1639	ATM
708	.6705	"	1640	ATM
715	.6749	✓	1642	ATM

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
57	72	38	1-22-09	1138	ATM
58	75	33	1-23-09	1150	PDG
56	76	25	1-26-09	1359	GRP
58	72	31	1/27/09	1530	PDG

Post	1-22	1.23	1.26
0.0000	0.0000	0.0000	0.0000
100.0000	99.9994	99.9993	99.9993

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date: 01.26.09 Time: 15:38 By: JRP

Beaker #	First Wt	2009 Date	Time	By	Second Wt	2009 Date	Time	By	Third Wt	Date	Time	By
20	73.3181	1/27	1532	PDG	73.3176	1-29	1459	JRP		1/30		
21	71.0021		1534	PDG	71.0018		1458	JRP				
22	71.8343		1535	PDG	71.8338		1457	JRP				
23	70.7390		1536	PDG	70.7389		1455	JRP				
27	72.3310		1538	PDG	72.3307		1500	JRP				
31	69.6672		1539	PDG	69.6669		1501	JRP				
32	53.6002		1541	PDG	53.5993		1502	JRP	53.5998		1305	PDG
37	53.7267		1542	PDG	53.7262		1504	JRP				
38	53.2525		1544	PDG	53.2516		1505	JRP	53.2520		1306	PDG
39	53.1509		1545	PDG	53.1493		1506	JRP	53.1496		1311	PDG
40	53.4626		1547	PDG	53.4622		1507	JRP				
41	52.8371		1549	PDG	52.8367		1508	JRP				
42	53.8699		1550	PDG	53.8692		1509	JRP	53.8696		1302	PDG

Checked By: ATM Date: 2/1/09 Time: 1210

QA REWEIGH

Beaker #	WT	Date	Time	By
20	73.3181	2/1/09	1215	ATM
31	69.6671		1217	ATM
42	53.8699		1216	ATM

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	2009 Date	Time	By
55	72	31	1/27	1530	PDG
58	77	29	1.29	1436	JRP
60	72	49	1/30	1256	PDG
58	74	37	2/1	1200	ATM

PST

1/27	1.29	1/30	2/1
0.0000	0.0000	0.0000	0.0000
99.9991	[illegible]	[illegible]	[illegible]

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Blank done 12/9/07

Into Dessicator: Date: 10/12/07 Time: 0801 By: GRP

Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
22	71.8343	10/22/07	1358	GRP	71.8332	11/10/07	1938		71.8330	11-11-07	1748	Dm
24	73.2192		1400	GRP	73.2190	11/10/07	1940		73.2193	11-11-07	1746	Dm
25	72.6516		1401	GRP	72.6512	11/10/07	1944	← Blank				
26	71.7895		1403	GRP	71.7888	11/10/07	1939		71.7886	11-11-07	1747	Dm
27	72.3316		1402	GRP	72.3314	11/10/07	1945					
28	70.5979		1404	GRP	70.5975	11/10/07	1941		70.5977	11-11-07	1745	Dm
39	53.1508		1405	GRP	53.1500	11/10/07	1942					
37	53.7237	11/10/07	1945	AM	53.7238	11/11/07	1743	Dm				

Checked By: ______________ Date: ______________ Time: ______________

QA REWEIGH

Beaker #	WT	Date	Time	By
27	72.3315	11-11	1740	Dm
25	72.6515	11-11	1741	Dm
39	53.1509	11-11	1744	Dm

2nd

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
57	68	50	10/22/07	1344	GRP
			11/10		

Post weighing
0.0000
1st
0.0000

55ml

WST5-Form9. Pg1 Rev4/90
Unit Kuh Ashwood
Run # EPA 4
Date: 3/2/09

WOODSTOVE DATA SHEET #4-3: C ANT FINAL WEIGHTS

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
27	72.3417	3/5	1357	ATM	72.3401	3/7	0900	ATM	72.3418	3/8	1430	[illegible]	72.3415	3/10	1214	PDG

FINAL FILTER WEIGHTS

	Filter #	Into Dessic	2009 Date	Time	By	First	Date	Time	By	Second	2009 Date	Time	By	Third	Date	Time	By
F	7/8	.1985	3/2	1900	ATM	.6984	3/3	1401	PDG	.6972	3/4		GRP	.6971	3/5	1356	ATM
R	7/7	.6438	3/2	1900	ATM	.6472	3/3	1436	PDG	.6470	3/4	1608	GRP				

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By
Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	2009 Date	Time	By	WB	DB	%RH
1	3/3	1431	PDG	59	76	35
2	3/4	1556	GRP	56	70	40
3	3/7	0850	ATM	57	71	41
4	3/8	1323	ATM	55	70	36
5	3/10	1212	PDG	60	75	[illegible]

SCALE ROOM ENVIRONMENTAL CONDITIONS

6						
7						
8						
9						

Comments

Acetone Lot # 041648

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

TARE 72.6512

Blank done 12/10/07

WST5-Form9,Pg1,Rev4/90
Unit Kuma Ashwood
Run # EPA 7
Date: 2/19/09

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	2007 Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
25	✓	12/12	1546	JRP	72.6508	12/13	1342	JRP	72.6511	12/14	1347	JRP				

FINAL FILTER WEIGHTS

Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By
Date	**Filter #**	**Final WT**	**By**

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	2007 Date	Time	By	WB	DB	%RH
1	12/13	1307	JRP	55	73	29
2	12/14	1321	JRP	57	75	31
3						
4						

SCALE ROOM ENVIRONMENTAL CONDITIONS

6						
7						
8						
9						

Comments

WOODSTOVE DATA SHEET 4-4 ANALYTICAL BALANCE QC RECORD SHEET

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

FROM: 12/20/08
THROUGH: 2/17/09

Level	Recalibrated	140 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	12/20/08	1430	ATM	58	72	42
✓	N	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	12/23/08	1057	JRP	60	76	38
✓	N	139.9994	99.9994	9.9999	1.0001	0.1000	0.0200	12/24/08	1019	ATM	59	72	45
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0200	12/26/08	1142	ATM	59	72	45
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0200	12/28/08	1050	ATM	60	75	37
✓	N	139.9994	99.9994	10.0000	.9999	0.1000	0.0199	1/05/09	1157	PDG	58	75	34
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	1/6/09	1845	ATM	60	75	37
✓	N	139.9995	99.9996	9.9999	1.0000	0.1000	0.0199	1/7/09	1530	JRP	58	70	48
✓	N	139.9994	99.9994	9.9999	.9999	0.1000	0.0199	1/8/09	1356	PDG	60	72	49
✓	Yes	139.9993	99.9994	9.9999	1.0000	0.1000	0.0200	1/09/09	1053	PDG	58	72	42
✓	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	1/11/09	1128	JRP	55	72	31
✓	Yes	139.9994	99.9995	9.9999	1.0000	0.1000	0.0199	1/12/09	0845	PDG	59	75	38
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0200	1/13/09	0825	JRP	58	74	37
✓	yes	139.9993	99.9994	9.9999	0.9999	0.1000	0.0199	1-14-09	1212	PDG	57	72	38
✓	NO	139.9993	99.9993	9.9999	1.0000	0.0999	0.0199	1/14/09	1420	JRP	59	75	37
✓	NO	139.9992	99.9993	10.0000	1.0000	0.0999	0.0199	1-15-09	1128	JRP	58	74	37
✓	yes	139.9994	99.9995	9.9999	0.9999	0.1000	0.0199	1-20-09	0950	PDG	58	74	37
✓	no	139.9993	99.9994	10.0000	0.9999	0.1000	0.0199	1-20-09	1230	PDG	56	71	37
✓	NO	139.9993	99.9993	9.9999	1.0000	0.0999	0.0199	1-20-09	1613	JRP	57	73	35
✓	No	139.9994	99.9994	9.9999	1.0000	0.1001	0.0200	1/22/09	1138	ATM	57	72	38
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	1/23/09	1150	PDG	58	75	33
✓	YES	139.9992	99.9993	10.0000	1.0000	0.0999	0.0200	1/26/09	1359	JRP	56	76	25
✓	no	139.9994	99.9995	10.0000	1.0000	0.1000	0.0199	1/27/09	1530	PDG	55	72	31
✓	No	139.9993	99.9993	10.0000	1.0001	0.1001	0.0200	1/28/09	1452	ATM	61	75	41
✓	YES	139.9993	99.9994	10.0000	1.0000	0.1000	0.0199	1-29-09	1436	JRP	58	77	29
✓	no	139.9995	99.9995	9.9999	0.9999	0.1000	0.0199	1/30/09	1256	PDG	60	72	49
✓	yes	139.9993	99.9994	9.9999	1.0000	0.1000	0.0199	2/1/09	1200	ATM	58	74	37
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	2/2/09	1350	JRP	58	77	29
✓	yes	139.9995	99.9996	9.9999	1.0000	0.1000	0.0199	2/5/09	1118	PDG	59	72	45
✓	NO	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	2/6/09	1150	JRP	57	74	33
✓	No	139.9994	99.9994	10.0000	1.0001	0.1000	0.0200	2/9/09	1015	ATM	49	70	19
✓	NO	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	2/16/09	1551	PDG	61	78	36
✓	NO	139.9993	99.9994	9.9999	1.0000	0.1000	0.0200	2/17/09	1439	JRP	56	72	35

WOODSTOVE DATA SHEET 4-4 SCALE QC RECORD SHEET

FROM: 9/27/2007
THROUGH: 12/7/2007

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

Level	Recalibrated	130 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	129.9998	99.9998	10.0000	1.0000	0.1000	0.0199	9/27/07	1402	GRP	55	67	45
✓	Y	129.9995	99.9996	10.0001	1.0000	0.1000	0.0200	9/28/07	1335	GRP	57	69	46
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0200	10/1/07	1505	ATM	58	70	48
✓	N	129.9995	99.9996	10.0000	1.0001	0.1000	0.0199	10/2/07	1611	GRP	56	68	46
✓	N	129.9997	99.9997	9.9999	1.0001	0.1000	0.0199	10/3/07	1122	GRP	56	68	46
✓	N	129.9996	99.9996	10.0000	1.0000	0.0999	0.0199	10/4/07	1225	GRP	55	67	45
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	10/5/07	0750	GRP	51	62	45
✓	N	129.9997	99.9997	9.9999	1.0000	0.1000	0.0199	10/5/07	1513	GRP	56	69	43
✓	Y	129.9996	99.9996	10.0000	1.0001	0.1001	0.0200	10/9/07	1505	ATM	58	71	44
✓	N	129.9996	99.9997	10.0000	1.0001	0.1001	0.0200	10/12/07	1259	ATM	58	70	48
✓	Y	129.9995	99.9996	9.9999	1.0000	0.1000	0.0199	10/22/07	1344	GRP	57	68	50
✓	Y	129.9996	99.9997	9.9999	1.0000	0.1000	0.0199	10/29/07	1338	GRP	53	63	50
✓	N	129.9995	99.9995	10.0000	1.0000	0.1000	0.0200	10/30/07	0933	ATM	56	70	40
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1000	0.0199	10/30/07	1457	GRP	55	70	36
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	10/31/07	1528	GRP	57	75	30
✓	Y	129.9996	99.9996	9.9999	1.0000	0.0999	0.0199	11/2/07	1238	GRP	52	67	33
✓	Y	129.9996	99.9996	10.0000	1.0001	0.1000	0.0199	11/5/07	0730	GRP	57	73	35
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1001	0.0201	11/9/07	1550	ATM	58	70	48
✓	N	129.9996	99.9997	10.0000	1.0000	0.1000	0.0200	11/10/07	1835	ATM	58	71	44
✓	Y	129.9997	99.9997	9.9999	1.0000	0.1000	0.0199	11/11/07	1810	ATM	55	69	39
✓	N	129.9997	99.9996	9.9999	1.0000	0.1000	0.0199	11/12/07	0822	GRP	54	67	41
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	11/13/07	1226	ATM	58	72	41
✓	N	129.9998	99.9997	9.9999	0.9999	0.1000	0.0200	11/14/07	1710	GRP	58	73	39
✓		QC Services Audit 11/14/07											
✓	Y	129.9997	99.9997	10.0000	1.0000	0.1000	0.0200	11/15/07	1358	ATM	59	72	45
✓	N	129.9996	99.9996	9.9999	0.9999	0.1000	0.0200	11/16/07	1600	GRP	58	71	44
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	11/18/07	1758	ATM	60	74	43
✓	Y	129.9997	99.9997	10.0000	1.0001	0.1001	0.0200	11/19/07	1143	ATM	56	70	40
✓	Y	129.9995	99.9996	10.0000	1.0000	0.1000	0.0199	11/20/07	1416	GRP	54	69	35
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	11/27/07	1110	ATM	57	70	44
✓	N	129.9995	99.9996	10.0000	1.0000	0.1000	0.0199	12/3/07	0730	GRP	55	69	40
✓	N	129.9996	99.9996	10.0000	1.0000	0.0999	0.0200	12/6/07	1125	ATM	54	67	44
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/7/07	1348	GRP	55	69	40

ATM

WOODSTOVE DATA SHEET 4-4 SCALE QC RECORD SHEET

FROM: 12/8/07
THROUGH: 2/3/08

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

Level	Recalibrated	130 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/8	1215	ATM	57	73	35
✓	N	129.9996	99.9996	10.0000	1.0000	0.1001	0.0200	12/8	1910	ATM	57	72	38
✓	N	129.9997	99.9996	10.0000	1.0000	0.1000	0.0199	12/9	1935	ATM	55	72	31
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/10	1953	ATM	56	72	34
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/11	1618	GRP	57	76	28
✓	N	129.9997	99.9996	10.0000	1.0000	0.0999	0.0199	12/12	1505	GRP/ATM	56	74	30
✓	N	129.9996	99.9996	9.9999	0.9999	0.1000	0.0199	12/13	1307	GRP	55	73	29
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	12/14	1321	GRP	57	75	31
✓	N	129.9998	99.9998	9.9999	1.0001	0.1000	0.0199	12/15	1602	GRP	57	75	31
✓	Y	129.9996	99.9997	9.9999	1.0000	0.1000	0.0199	12/17	0817	GRP	55	73	29
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/18	0853	GRP	58	75	34
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/19	0812	GRP	55	72	31
✓	Y	129.9995	99.9996	10.0000	1.0001	0.0999	0.0199	12/20	0916	GRP	57	71	41
✓	Y	129.9998	99.9997	10.0000	1.0000	0.1000	0.0199	12/21	1085	ATM	55	70	36
✓	N	129.9997	99.9996	10.0000	1.0000	0.10000	0.0200	12/22	1434	[illegible]	54	66	44
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/23	0915	ATM	57	70	44
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	12/26	1230	ATM	57	70	44
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0200	12/27	1030	ATM	56	72	34
✓	N	129.9998	99.9997	9.9999	1.0000	0.1000	0.0200	1/8/08	1342	GRP	54	68	38
✓	N	129.9997	99.9997	10.0000	1.0001	0.1000	0.0200	1/9/08	0742	GRP	55	70	36
✓	N	129.9998	99.9998	10.0000	1.0000	0.1000	0.0199	1/11/08	1040	ATM	59	73	42
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1000	0.0199	1/16/08	1221	GRP	51	72	18
✓	N	129.9999	99.9998	10.0000	1.0000	0.1000	0.0199	1/17/08	1237	GRP	56	71	37
✓	N	129.9998	99.9998	10.0000	1.0000	0.0999	0.0200	1/18/08	1116	GRP	56	71	37
✓	Y	129.9995	99.9996	9.9999	1.0001	0.1000	0.0199	1/21/08	1426	GRP	56	72	34
✓	N	129.9995	99.9996	10.0000	1.0001	0.1000	0.0199	1/22/08	1513	GRP	56	71	37
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	1/23/08	0805	GRP	54	69	36
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	1/24/08	0758	GRP	54	70	33
✓	N	129.9998	99.9997	10.0000	1.0000	0.1000	0.0199	1/24/08	1450	GRP	56	71	37
✓	N	129.9997	99.9996	10.0000	1.0000	0.1000	0.0200	1/31/08	1505	GRP	55	69	38
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	2/1/08	1029	GRP	54	69	36
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	2/2/08	1620	ATM	58	72	41
✓	N	129.9996	99.9997	10.0000	1.0001	0.1000	0.0200	2/3/08	1710	ATM	57	70	44

WOODSTOVE DATA SHEET 4-4 ANALYTICAL BALANCE QC RECORD SHEET

FROM: 2/10/09

THROUGH:

SCALE: SARTORIUS

MODEL: CP224S

SN: 17050374

Level	Recalibrated	140 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
Y	Y	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	2/10/09	1800	ATM	55	70	36
Y	Y	139.9993	99.9994	9.9999	1.0000	0.1000	0.0199	2-19-09	1248	JRP	56	73	32
Yes	Y	139.9993	99.9994	9.9999	0.9999	0.1000	0.0199	2/20/09	1018	PDG	57	74	33
Yes	Y	139.9993	99.9994	10.0000	1.0000	0.1000	0.0200	2/21/09	1519	ATM	60	77	35
Yes	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	2/22/09	1222	ATM	47	59	37
Y	Yes	139.9994	99.9994	9.9999	0.9999	0.1000	0.0199	2/23/09	1406	PDG	58	70	48
Yes	No	139.9994	99.9994	9.9999	1.0000	0.1000	0.0200	2/24/09	0953	ATM	59	76	35
Yes	Yes	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	2/25/09	1123	PDG	60	76	38
Yes	Yes	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	2-26-09	1258	JRP	55	70	36
YES	YES	139.9993	99.9993	9.9999	1.0001	0.1001	0.0200	2/28/09	1330	ATM	57	74	33
Yes	Yes	139.9995	99.9995	9.9999	0.9999	0.1000	0.0199	3/3/09	1431	PDG	59	76	35
Yes	NO	139.9993	99.9995	9.9999	1.0000	0.1000	0.0199	3/4/09	1556	JRP	56	70	40
Yes	No	139.9994	99.9994	9.9999	1.0001	0.1001	0.0200	3/5/09	1350	ATM	60	75	40
Yes	No	139.9993	99.9993	9.9999	1.0000	0.1000	0.0200	3/7/09	0850	ATM	57	71	41
Yes	Yes	139.9993	99.9993	10.0000	1.0001	0.1000	0.0200	3/8/09	1323	ATM	55	70	36
Yes	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	3/10/09	1212	PDG	50	75	10

Woodstove Particulate
Catch Processing Sheet
Woodstove Data Sheet #5
EPA M5G-1

Unit: Kuma Ashwood
Run: EPA 7
Date: 3/2/09
Technicians: ADM JRP PDG
Revised 1/16/98-Data Sheet #5

Filters

Filter # (Front) 718 Beaker # 27
Final Wt. .6971 g Ml 55 ml.
Tare Wt. .6723 g Desc. Acetone
Net Wt. .0248 g

Final Wt. 72.3415 g
Tare Wt. 72.3307 g
Net Wt. .0108 g

Filter # (Rear) 717 Beaker # ______
Final Wt. .6470 g Ml ______
Tare Wt. .6536 g Desc. ______
Net Wt. -.0066 g

Final Wt. ______ g
Tare Wt. ______ g
Net Wt. ______ g

Acetone Blank Calculation:

Blank Date: 12/18/07
Blank Beaker # 25
Final Wt. 72.6511 g
Ml 50
Tare Wt. 72.6512 g
Desc. Acetone
Net Wt. -0.0001 g ≈ 0.0000

.0000 g ÷ 50 ml = .0000 g/ml

Blank Residue Value Calculation:

.0000 g/ml acetone X 55 ml acetone = .0000 g
Blank Residue Value

Total Particulate Catch Calculation

Filter: .0248 g
Filter: -.0066 g
Beakers: .0108 g (Total Catch) - .0000 g (Blank Residue Value) = .0108 g

Total Catch = .0290 g

Unit Kuma Ashwood
Run # EPA 1
Date 3/2/09
Technician AMM JBP PDG
WST6-Form1,Rev8/96

MISCELLANEOUS TEST DATA
WOODSTOVE DATA SHEET #8

Useable Firebox Dimensions: See QC Section Useable Volume: 2.094 ft^3

Dilution Tunnel Draft (If applicable): Start .000 Stop .000 "H_2O

Test Chamber Air Velocity: Start: 00.0 Stop: 00.0 Avg: 00.0 Ft./Min

Wet Bulb/ Start: WB: 57 °F DB: 69 °F 1.15% Amb Moisture 47 %RH

Dry Bulb Stop: WB: 60 °F DB: 75 °F 1.25% Amb Moisture 40 %RH

$\bar{X}$ = 1.20 % Ambient Moisture $\bar{X}$ = 43.5 % Relative Humidity (RH)

Empty Stove Wt: 440.2 lbs.

Empty Stove Wt with Stack (Inc. Oil Seal) Wet: 765.5 lbs. Dry: 765.6 lbs.

Empty Stove Wt with Stack and Ash Ash: — lbs. Total: — lbs.

Kindling Wt. Total 5.1 Paper: .3 lbs. Wood: 4.8 lbs.

Pre Burn Fuel Wt. 11.994 + 12.942 + 10.690 Total: 35.626 lbs.

otal Kindling and Pre Burn Fuel Wt 40.726 lbs.

Coal Bed Wt-lbs: Range (3.3 - 2.7) 768.9-768.3 lbs. Actual: 2.9 768.5 lbs.

Allowable Amount of Charcoal that can be removed:

Coal Bed Wt. Range 3.3 (Upper Wt.) + 2.7 (Lower Wt.) /2 X .25 = 0.70 lbs.

Test Fuel Wt-lbs: Ideal 14.7 lbs. Range: 16.1 - 13.2 lbs. Actual: 13.330 lbs.

Test Fuel Size (pcs.) (.75 x 1.5 x 5" Flanges) 1.348 lbs. 16 Pcs.

2 x 4's x 16.4375 " 3 Pcs 6.584 lbs. 49.39 %

4 x 4's x 16.4375 " 2 Pcs 6.746 lbs. 50.61 %

5.0283 kg

Est. Dry Burn Rate (Kg/Hr.) $\frac{13.330 - (13.330 \times .16838)}{2.2046} \times \frac{60}{285}$ = 1.0586 Est. Dry Burn Rate (Kg/Hr)

Est EPA Heat Output (HO_E) (Avg BTU's/Hr) (19,140) x $\frac{63}{100}$ x 1.0586 = 12,765 Est Heat Output (HO_E) BTU's/Hr

Comments:

Stove Operating Data
Woodstove Test Data Sheet #9
Cold Start

Unit: Kuma Ashwood
Run: EPA 7
Date: 3/2/09
Technician(s): ATM JRP ADG
Data Sheet#9--Rev 1/98-Pg.2

Fire Started: 10:15

Warm up and Preburn: Primary Air: Wide open from ignition until the start of preburn when the primary air control(s) was (were) adjusted to the run setting of 2.475 on thr. rod. At the run setting until the start of the test. .467 PAC

Secondary Air: No Controls. Naturally drafted

Secondary Burn Bypass: N/A

Charcoal Bed Preparation: Broke up, raked and leveled the coal bed prior to the addition of each warm up/pre burn fuel charge. Starting 1:30 before the start of the test, broke up, raked and leveled the coal bed. In stove for 30 seconds.

Test: Door wide open during loading / min / sec, then closed.

Primary Air: Wide open from the start of the test (0:00) until 4:45. Adjusted to the run setting of 0.467" between 4:45 and 5:00. At the run setting of 0.467" at 5:00 into the run.

Secondary Air: No Controls. Naturally drafted.

Secondary Burn Bypass: N/A

Fan: ON/OFF during the warm up, ON/OFF Low during the preburn, ON/OFF at the start of test, ON/OFF for the first 30 minutes of test, ON/OFF Low at 30 minutes into test, ON/OFF for the rest of test.

Test Run Anomalies: Another good smoor E Run

Unit Kuma Ashwood
Run # EPA 7
Date 3/2/09
Technician ATM JRP POG
Page 1 of 4
WST7-Form2-A, Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-1

Wood Data: Kindling: A mix of the below grades

	Size	Mill	Grade	Species
Pre Burn	2X4	Forest Grove	#2 & BTR	D.Fir Sfc. Grn
Test Fuel	2X4	Forest Grove	#2 & BTR	D.Fir Sfc Grn
	4X4	"	#1	"

All grades WCLB Rules unless otherwise noted.

Warm up Information:

1st Warm up/Pre Burn Fuel charge (11.994 lbs) added at 10:29.
2nd Warm up/Pre Burn Fuel charge (12.942 lbs) added at 11:21.
3rd Warm up/Pre Burn Fuel charge (10.690 lbs) added at 12:18.
4th Warm up/Pre Burn Fuel charge (________lbs) added at ________.
5th Warm up/Pre Burn Fuel charge (________lbs) added at ________.
6th Warm up/Pre Burn Fuel charge (________lbs) added at ________.
7th Warm up/Pre Burn Fuel charge (________lbs) added at ________.
8th Warm up/Pre Burn Fuel charge (________lbs) added at ________.

1st Rick - 4-12", 4-16" 2x4's
2nd Rick 8-16" 2x4's
3rd Rick 4-12", 3-16" 2x4's

The coals were scooped out of the stove immediately prior to adding the 3rd pre burn/warm up fuel charge. The stove lost 0.0 lbs. 2.0 lbs. of coals were put back in the stove after the scoop.

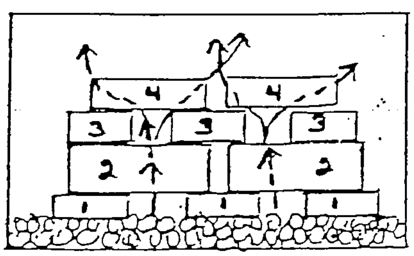
All pre burn/warm up fuel pieces were either 12 or 16 inches long. All preburn pieces/fuel charges were "ricked" in the stove. The pieces in the bottom layer in each rick contained 2 pcs that were 12 or 16 inches long and were loaded flat and perpendicular to the door. The pieces in the second layer in each rick were loaded on their side (edge) approximately parallel to the door and contained 3 or 4 pcs 16 inches long. The third layer (and fourth layer if present) was loaded flat, perpendicular to the door and contained 2 pcs 12 or 16 inches long. The majority of the pieces in each rick were in the second layer which had an approximate 0.5-1.0" space between pieces. (The loading directions indicate the direction of the longest dimension on each piece relative to the loading door opening.) Each pre burn/warm up fuel charge normally weighs within the weight range allowed for the actual test fuel charge

Unit: Kuma Ashwood
Run # EPA 1
Date 3/2/09
Technician AMM JRP PDG
Page 2 of 4
WST7-Form2-A, Rev 6/90

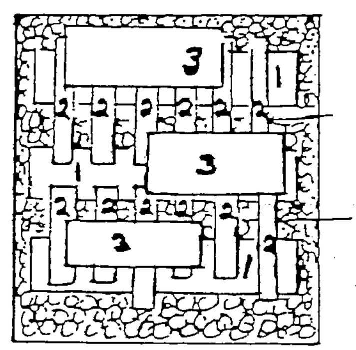
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-2

Warm up Information (cont.):

Each warm up/preburn fuel charge was ricked in exactly (as much as possible) the same manner and the weight of each rick was usually within the allowable weight range for the test fuel charge. The physical arrangement and alignment of each rick was designed to accomplish three (3) things: (1)The bottom layer was nestled firmly into the coal bed and was as close to being level with the bottom of the stove as possible, thus providing a stable loading platform for the rest of the rick, keeping it in a ricked state (as opposed to a col- lapsed or fallen down state) untill the rick reached the charcoal stage and sags or collapses of its own accord. (2) It enhances the flow of primary air through the ricked preburn fuel charge, for the primary air would flow through the spaces between the pieces in the first layer and then up through the spaces between the pieces in the second, third and, if present, fourth layers. (3) It maximized, as much as possible, the surface to volume ratio of each preburn fuel charge, thereby allowing the fire immediate access to as much wood surface as possible and, thereby, insuring uniform charcoalization. All three of these enhance combustion and so get the stove as hot as possible during the warm up period, therby maximizing the amount of heat (BTU's) stored in the stove. The actual preburn was not started until the stove surface temperatures had maximized and stabilized, thus indicating that the amount of heat stored in the stove had peaked. For this stove, the thermal storage was monitored using the Stove Top T/C surface temperature(s) and the peak value(s) obtained were 1102 °F. 1102



Front View



Top View

The arrows indicate the direction of the air flow through the rick.

The primary air was adjusted to the run setting of 0.467" open 4.0 lbs above the upper charcoal bed weight.

Unit Kuma Ashwood
Run # EPA 4
Date 3/2/09
Technician AM JEP POG
Page 3 of 4
WST5-Form2-Rev11/89

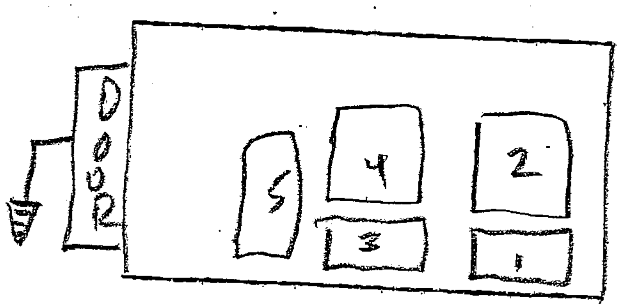
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-3

Additional Comments: Test Start Sequence: (1) Turned Fan OFF (2) Adjusted Primary Air Control to Wide Open (3) opened door (4) Loaded fuel (5) Cleared coals away from in front of the LPAO (6) Closed door

Total Elapsed Time: 1:01
Photo @ 1:55

Test Fuel Charge Loading Information:

Test Fuel Charge and Loading Sequence Diagram



SIDE of stove view
4 X 4's: 2 & 4
2 X 4's: 1, 3 & 5
Loading Sequence: 1, 2, 3, 4 & 5 /ASO
Driest Pcs in Load 5, 3

Loaded the test fuel charge on an essentially level; Medium sized, Avg to hot coal bed (in appearance, color and temperature for a M.Low (1.0-1.25) burn rate. Load: 1:01 Ignition: 1:01
1:01 Door Closed.
1:05 Vertical Column of Flame (VC) up to baffle.
1:55 Photo
2:36 Flames full width of front of pc 5.
3:10 Secondaries forward past the front tube.
4:45-5:00 Primary Air Control adjusted to the run setting
5:00 Flames decreasing, Maintained a hot pocket of coals underneath and behind pc 5 with a small VC with Secondaries above 4.
6:00 Secondaries have decreased and are flashing on/off behind the VC.
6:44 7.5/1.21 (%CO_2/%CO) M/MH, VC flickers to baffle.

Unit Kuma Ashwood
Run # EPA 7
Date 3/2/07
Technician APM JRP PDG
Page 4 of 4
WST5-Form2-Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-4

Additional Comments:

7:50 VC ~~su~~ sowing up and down, Secondary flashes above 4.
9:10 Small pop
9:25 No Secondaries M/MH
10:08 Secondaries flashing on/off again.
10:30 6.0/1.09 M/MH
11:00 Steady secondaries above pc 4
12:19 VC Widening at base, especially to the L.
15:43 7.2/1.14 M/MH
16:03 secondaries flashing to both L and R of center
17:46 Secondaries to the L end of 4
18:42 9.43/1.33 Secondaries flashing forward past front tube left of center.
19:38 flames on the center top edge of pc 5 9.68/1.32
20:28 Velocity in secondaries - are lifting off the tubes.
20:34 9.9/1.29
21:02 secondaries forward past the front tube 10.33/1.25 M/MH
23:08 BIG POP. All Flames out for ~ 3 seconds.
23:54 No real VC - due to pop. Only secondaries - top down burn MH.
25:38 10.91/1.19 M/MH
25:52 Another big pop
26:27 Gas Balance 10.8/1.08
27:14 Real VC again
28:00 VC out again. Secondaries really increasing. whole right side of door glass is black.
30:00 Fan On Low.

Unit: Kuma Ashwood
Run: EPA 7
Date: 3/2/09
Technician: ATM JRP PDG
WST1-Form7-Rev11/89

FUEL MOISTURE
WOODSTOVE TEST DATA SHEET #10

5 kg = 11.024 lbs 1.0 kg = 2.204 lbs.

Room Temperature: 60.1 °F

Correction Factor: +1.0

NOTE: Record readings to the nearest 0.5% moisture
Uncor Values are corrected for temperature: Yes ✓ No ______
Time Test Fuel Moisture Readings taken at: 11:15
Calibration Checks: X ___ Y ___ 12.0 11.8 22.0 22.1

	Pc #	Dimen	Use	Top Uncor	Top Cor	Bottom Uncor	Bottom Cor	Side Uncor	Side Cor	Piece Avg Corrected
	1	3 pcs	K	7.5	7.85	7.5	7.85	7.75	8.08	7.927
	2									
	3									
	4	2X4-8'	P	19	20.3	18	19.2	18	19.2	19.567
	5	↓	↓	18	19.2	18	19.2	18.5	19.8	19.400
	6			19	20.3	19	20.3	19.5	20.9	20.500
	7			20.5	22.0	20.5	22.0	22	23.7	22.567
	8			20.5	22.0	20	21.4	20	21.4	21.600
	9									103.634
	10									
1.[illegible]	11	2X4-16 7/16	T	18	19.2	18	19.2	18	19.2	19.200
1.666	12	↓	↓	18.5	19.8	18	19.2	18	19.2	19.400
2.586	13			22	23.7	21	22.6	20.5	22.0	22.767
	14									
2.880	15	4X4-16 7/16	T	20	21.4	18	19.2	18	19.2	19.933
3.548	16	↓	↓	19	20.3	19	20.3	18	19.2	19.933
	17									101.233
	18									
1.348	19	Spacers	T	19	20.3	18	19.2	18	19.2	19.567
	20								OUT	Spacers

	Kindling	Pretest Fuel	Test Load
% Moisture - Dry Basis:	7.927 %	20.7268 %	20.2466 %
% Moisture - Wet Basis:	7.345 %	17.1684 %	16.838 %

4X4
13.330 6.746

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

5.0284 kg

1	11.994
2	12.942
3	10.690

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

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

2X4 = 1.231

Unit: Kuma Ashwood
Run#: EPA 4
Date: 3/2/09
Technician: AM JRP POG

WOOD DENSITY DETERMINATION
WOODSTOVE TEST DATA SHEET #11

WST2-form11-Rev 6/90

Wood Piece: Nominal Dimensions: 2X4 1.5 x 3.5 x 3.5"

Depth (D): 3.820 cm

Width (W): 8.860 cm

Length (L): 8.915 cm
8.925 cm
8.975 cm
9.025 cm

Length $\bar{X}$ = 8.960 cm

Volume: 303.253 cm^3
(D X W X L)

MOISTURE: Room Temperature: 60.1 °F Correction Factor: +1.0

Uncorrected Meter Readings Corrected for temperature: Yes ✓ No ___

NOTE: Record moisture meter readings to the nearest 0.5%

	Uncor	Cor
Top:	18	19.2 %
Bottom:	18	19.2 %
Side:	18	19.2 %
$\bar{X}$:		19.2 %

Avg % Moisture (Dry) 19.200 %

Aug % Moisture (Wet) 16.107 %

Scale: Leveled In ✓ Out ✓

Zeroed: In ___ Out ✓

Wet Weight: 159.2 g Dry Weight: 137.9 g

% Moisture Dried Basis: 13.379 %
[1 - (Dry Wt ÷ Wet Wt)] X 100

	Date	Time	Temp
Into Dryer	3/2/09	1640	192 °F
Out of Dryer	4/3/09	1245	196 °F

(Minimum Time in Dryer: 24 hrs.) Minimum Dryer Temp 100°C (212°F)

Density = 137.9 g (dry wt) ÷ 303.253 cm^3 (volume) = 0.4546 g/cm^3

Pellet Fuel Moisture Content Determination

Tare Beaker Wt. ______ g

Wet Wt: ______ g - ______ g = ______ g
Gross Wet Wt. Tare Beaker Wt. Net Wet Wt.

Dry Wt: ______ g - ______ g = ______ g
Gross Dry Wt. Tare Beaker Wt. Net Dry Wt.

% Moisture Dried Basis: ______ %
[1 - (Net Dry Wt ÷ Net Wet Wt.)] X 100

Pre Burn 4.0 lbs./hr

Tare WT. 772.9 lbs.

Test Stove wt. Range 768.9 - 768.3 lbs.

PRE BURN DATA
RECORD SHEET #13
WST2-Form16

BARO. PRESSURE 28.17 "Hg

Unit: Kuma Ashwood
Run: EPA 7
Page: 1 of 1

Date: 3/2/09
Technician(s): ATM JRP PDG

Hot Box On ✓

Minute	Time	Scale Weight	Burn Rate	T/C#-3 Stack	4 Stove Top	5 Left Side	6 Back	7 Right Side	8 Bottom	9 Firebox	10 2nd Burn	17 Catalytic	11 Room Temp	Static	Comments (RAKE FWD @ 1130)
0	1240	772.9	0	685	1001	586	385	576	344	1019	1363	1193	81	-.074	
5	45	772.2	.17	499	956	600	398	587	356	993	1356	1387	80	-.066	Primary Air Set at 2.475"+
10	50	771.5	.17	454	698	603	405	592	363	986	1369	1386	80	-.064	Secondary Air Set at Fixed
15	55	770.9	.16	436	677	604	406	589	367	991	1390	1353	79	-.063	Fan: High @ coal Low @ S/D
20	1300	770.5	.4	407	647	606	407	587	368	994	1400	1412	78	-.059	Tunnel on at: 1314
25	05	770.0	.5	387	612	611	411	591	368	995	1400	1447	79	-.057	Buckets Iced ✓
30	10	769.7	.3	365	777	620	418	591	366	1006	1359	1415	80	-.053	Analyzers Spanned ✓
35	15	769.5	.2	332	715	617	428	586	354	1000	1304	1386	79	-.050	Pumps turned on at: 1343
40	20	769.3	.2	313	663	606	436	577	363	965	1271	1297	79	-.048	540.0 ΔT ΔAT
45	25	769.1	.2	297	621	593	440	566	363	975	1201	1202	79	-.045	529.0 -11.0
50	30	769.0	.1	283	584	579	437	554	362	949	1096	1070	78	-.043	Check WB/DB: 516.6 -12.4
55	35	768.9	.1	282	547	561	430	540	362	878	1146	929	76	-.043	503.2 -13.4
		-		-										-	488.0 -15.2
60	1340	768.8	.1	269	526	540	416	523	362	827	1007	982	77	-.040	Probe In Tunnel
65	45	768.7	.1	260	507	520	406	505	362	793	940	956	75	-.039	Tunnel ΔP 474.2 -13.[illegible]
70	50	768.6	.1	255	467	503	399	490	361	766	917	827	76	-.036	460.0 -14.[illegible]
75	55	768.5	.1	251	470	467	390	477	360	757	905	920	76	-.036	448.0 -12.[illegible]
80															436.8 -11
85															
90															

RAKE FWD @ 30min or Burnout

Start 435-440 °F

Myren Consulting Inc Data Sheet P1 of 5 Unit KUMA ASHWOOD Date 3 / 6 / 04 Run ...
Test End 768.5 ΔT 436% Barometric Pressure 28.16 "hg Gas Flows @ 1.5" Technician(s) ATM JRP ...

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
0	1355	781.8	13.3	0	.1269	6.70		13.59	.122	1.22	51.5	Bu OFF				251	-.036
05	1400	781.4	12.9	.4	.172	4.30		14.14	.092	.92	41.7	MHH				346	-.053
10	05	781.0	12.5	.4	.232	5.79		14.56	.111	1.11	51.2	m mH				299	-.045
15	10	780.7	12.2	.3	.233	5.81		14.56	.106	1.06	51.5	m-mH				272	-.044
20	15	780.3	11.8	.4	.305	7.59		12.69	.123	1.23	6.2	"				276	-.044
25	20	779.8	11.3	.5	.404	10.04		10.25	.123	1.23	8.2	m				292	-.047
30	25	779.2	10.7	.6	.449	11.15		9.21	.107	1.07	10.4	m-mL 26:26 Fan on				304	-.048
35	30	778.6	10.1	.6	.620	15.38		4.86	.133	1.33	11.6	mL ?! thermo. unfile				346	-.053
40	35	778.0	9.5	.6	.615	15.25		5.06	.117	1.17	13.0	light 31xx				358	-.053
45	40	777.5	9.0	.5	.581	14.41		6.00	.097	.97	14.9	L-wispy				355	-.053
50	45	776.9	8.4	.6	.608	15.08		5.39	.088	.87	17.3	wisps				360	-.054
55	50	776.4	7.9	.5	.568	14.09		6.37	.087	.87	16.2	W → L 5 through				354	-.054
Tot																3813	.584

Time E/T	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2nd burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 #19	Tube 3 #20
0	1355	470	467	390	477	360	757	905	76	95	216	34	79	57	820			
05	1400	445	471	377	461	360	662	1141	78	115	226	34	60	37	979			
10	05	462	464	362	450	357	624	1058	77	101	232	35	63	36	976			
15	10	469	445	345	431	356	599	1259	77	97	222	35	62	36	1103			
20	15	466	435	334	417	353	603	1250	77	96	212	35	62	36	1247			
25	20	484	435	323	414	349	619	1245	77	97	216	36	62	36	1258			
30	25	507	437	315	416	344	634	1279	77	97	222	37	62	36	1330			
35	30	575	446	306	427	334	676	1347	77	99	221	37	62	37	1287			
40	35	625	446	299	436	327	697	1362	77	99	221	37	61	36	1257			
45	40	647	451	293	446	320	719	1384	77	99	222	37	62	37	1258			
50	45	671	457	288	462	313	755	1368	75	100	224	38	82	38	1259			
55	50	673	464	284	471	307	791	1361	74	99	222	38	80	37	1281			
Tot		6516	5440	3916	5310	4080	8136	14959	919	1??								

Myren Consulting Inc Data Sheet P2 of 3 Unit KUMA ASHWOOD Date 3 / 2 / 09 Run CNA 4

Test End 768.5 ΔT 436.8 Barometric Pressure 28.11 hg Gas Flows @ 1.5" Technician(s) ATM JRP

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
60	1455	775.9	7.4	.5	.628	15.57		4.71	.123	1.23	12.7	W-L 3 stmn				362	-.054
65	1500	775.3	6.8	.6	.632	15.67		4.47	.152	1.52	10.3	" Sis				364	-.054
70	05	774.8	6.3	.5	.607	15.05		5.12	.145	1.45	10.4	WISPS				359	-.053
75	10	774.3	5.8	.5	.579	14.36		6.00	.107	1.07	13.4	clear				348	-.051
80	15	773.9	5.4	.4	.558	13.84		6.73	.066	.66	21.0	"				340	-.050
85	20	773.5	5.0	.4	.579	14.36		6.16	.075	.75	19.2	"				340	-.050
90	25	773.1	4.6	.4	.573	14.21		6.23	.091	.91	15.6	"				338	-.050
95	30	772.7	4.2	.4	.565	14.02		6.49	.099	.99	17.7	"				334	-.049
100	35	772.3	3.8	.4	.528	13.10		7.22	.115	1.15	11.4	W-L				324	-.048
105	40	772.0	3.5	.3	.517	12.83		7.44	.125	1.25	10.3	Light				317	-.047
110	45	771.6	3.1	.4	.535	13.28		6.94	.137	1.37	9.7	"				317	-.047
115	50	771.3	2.8	.3	.532	13.20		7.08	.123	1.23	10.7	"				313	-.046
Tot																4056	.599

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2^{nd} burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 #19	Tube 3 #20
60	1455	688	474	283	476	303	838	1368	75	99	219	38	81	38	1311			
65	1500	699	465	284	461	300	862	1330	76	99	220	38	61	37	1331			
70	05	702	496	285	486	296	886	1324	76	98	226	38	80	36	1267			
75	10	690	505	286	491	294	901	1331	76	98	229	38	80	36	1189			
80	15	677	510	292	496	293	906	1305	77	97	227	38	61	37	1210			
85	20	670	517	297	499	292	916	1301	77	98	221	38	61	37	1253			
90	25	666	523	304	499	292	911	1303	76	97	219	39	61	37	1276			
95	30	664	526	313	499	293	901	1251	77	97	217	39	61	37	1361			
100	35	651	530	320	499	293	889	1258	76	97	217	39	61	37	1362			
105	40	638	531	334	499	294	880	1265	76	96	216	39	61	37	1420			
110	45	634	538	352	499	294	887	1272	76	96	217	39	61	37	1409			
115	50	633	540	360	502	295	886	1250	76	95	220	39	61	37	1416			
Tot		8014	6177	3710	5926	3539	10663	15558	914									

Myren Consulting Inc Data Sheet P3 of 5 Unit Kuma Ashwood Date 3 / 2 / 09 Run EPA 7
Test End 766.5 ΔT 436.8 Barometric Pressure 28.15 "hg Gas Flows @ 1.5" Technician(s) ATM JRP

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
120	1555	771.1	2.6	.2	.402	9.99		10.53	.076	.76	13.1	clear				268	-.043
125	1600	771.0	2.5	.1	.349	8.68		11.79	.087	.87	10.0	"				271	-.040
130	05	770.9	2.4	.1	.325	8.09		12.29	.105	1.05	7.7	"				264	-.039
135	10	770.8	2.3	.1	.320	7.96		12.33	.121	1.21	6.6	"				256	-.038
140	15	770.7	2.2	.1	.310	7.72		12.47	.143	1.43	5.4					248	-.037
145	20	770.6	2.1	.1	.312	7.76		12.39	.150	1.50	5.2					244	-.036
150	25	770.5	2.0	.1	.306	7.62		12.54	.148	1.48	5.1					240	-.035
155	30	770.4	1.9	.1	.310	7.72		12.37	.162	1.62	4.8	"				236	-.034
160	35	770.3	1.8	.1	.306	7.62		12.43	.171	1.71	4.5					233	-.033
165	40	770.2	1.7	.1	.304	7.57		12.39	.189	1.89	4.0					230	-.033
170	45	770.1	1.6	.1	.297	7.39		12.53	.195	1.95	3.8					226	-.032
175	50	770.1	1.6	0	.292	7.27		12.63	.200	2.00	3.6					223	-.031
Tot																2959	.431

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2nd burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 AT #19	Tube 3 4AT #20
120	1555	605	534	376	501	295	865	1175	77	94	221	39	80	37	1355			
125	1600	570	525	380	496	296	845	1073	76	92	221	38	80	37	1223			
130	05	545	516	381	490	296	834	1022	76	92	221	38	80	37	1133			
135	10	519	506	384	483	296	816	976	76	91	221	38	80	37	1096			
140	15	499	497	388	475	296	801	943	76	91	221	38	80	37	1054			
145	20	482	490	387	469	295	791	920	76	91	220	37	80	37	1051			
150	25	469	484	389	463	295	781	914	76	91	219	37	80	37	1050		420.0	-16.8
155	30	455	478	391	456	296	767	909	76	91	217	37	80	37	1041		415.2	-21.6
160	35	445	474	392	451	295	758	894	76	91	218	37	80	37	1022			
165	40	436	469	389	446	295	748	879	76	91	218	37	80	37	1010		407.0	-29.8
170	45	428	466	389	442	295	740	869	77	91	219	37	80	37	1004			
175	50	421	462	390	438	295	731	858	77	91	220	37	81	37	976		401.2	-35.6
Tot		5874	5901	4636	5610	3545	9477	11432	915									

Myren C[illegible]ulting Inc Data Sheet P4 of 5 Unit Kuma As/ Yood Date 3 / 2 / 09 Run [illegible]A 7
Test End [illegible] 7685 ΔT 436.8 Barometric Pressure 28.14 "hg Gas Flows @ 1.5" Technician(s) Arm JRP [illegible]

Time E/T min	Time	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
180	1655	770.0	1.5	.1	.287	7.15		12.71	.209	2.09	3.4					220	-.031
185	1700	769.9	1.4	.1	.282	7.02		12.82	.212	2.12	3.3					218	-.030
190	05	769.8	1.3	.1	.282	7.02		12.79	.218	2.18	3.2					212	-.030
195	10	769.7	1.2	.1	.274	6.83		13.08	.199	1.99	3.4					215	-.030
200	15	769.7	1.2	0	.261	6.50		13.34	.212	2.12	3.1					213	-.029
205	20	769.6	1.1	.1	.263	6.55		13.24	.222	2.22	3.0					211	-.029
210	25	769.5	1.0	.1	.256	6.38		13.39	.225	2.25	2.8					211	-.028
215	30	769.4	.9	.1	.260	6.48		13.31	.223	2.23	2.9					209	-.028
220	35	769.4	.9	0	.262	6.53		13.24	.226	2.26	2.9					208	-.028
225	40	769.3	.8	.1	.255	6.36		13.38	.232	2.32	2.7					206	-.028
230	45	769.2	.7	.1	.246	6.13		13.53	.247	2.47	2.5					206	-.028
235	50	769.1	.6	.1	.237	5.91		13.79	.239	2.39	2.5					204	-.027
Tot																2533	.346

Time E/t	Time	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2^{nd} burn #10	Amb. #11	Tnl. #12	C Gas. H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 ΔT #19	Tube 3 ΔΔT #20
180	1655	413	456	389	433	294	720	836	76	91	220	36	61	37	922			
185	1700	407	453	391	430	294	712	829	77	91	222	37	61	37	922		395.0	-41.8
190	05	399	447	389	425	292	704	815	76	90	220	36	61	36	921			
195	10	396	446	386	422	292	719	820	77	91	216	36	61	37	877		388.4	-48.4
200	15	392	443	382	420	293	711	811	77	91	216	37	62	37	858			
205	20	386	439	378	417	293	703	805	77	91	216	37	62	37	850		383.0	-53.8
210	25	384	435	371	414	292	693	801	77	91	216	37	62	37	844			
215	30	381	430	366	411	290	695	795	77	91	217	37	62	37	841		375.6	-61.2
220	35	378	427	364	409	290	691	786	77	91	218	37	63	37	827			
225	40	375	423	364	406	289	685	774	77	91	219	37	62	37	815		371.4	-65.4
230	45	372	420	363	404	288	676	763	78	91	219	37	63	37	803			
235	50	368	416	362	401	288	666	754	78	91	219	37	63	37	792		367.0	-69.8
Tot		4653	5235	4505	4992	3495	8375	9589	924									

Myren ( )ulting Inc Data Sheet P5 of 5 Unit Kuma As)000 Date 3 / 2 / 09 Run JRA 7
Test End Wt 768.5 ΔT 436.8 Barometric Pressure 29.12 "hg Gas Flows @ 1.5" Technician(s) ATM JRP RDG

Time E/T min	Time	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
240	1755	769.1	.6	0	.227	5.66		13.99	.249	2.49	2.3					203	-.027
245	1800	769.0	.5	.1	.220	5.49		14.10	.262	2.62	2.1					201	-.027
250	05	768.9	.4	.1	.213	5.32		14.25	.266	2.66	2.0					200	-.027
255	10	768.9	.4	0	.211	5.27		14.30	.267	2.67	2.0					198	-.026
260	15	768.8	.3	.1	.207	5.17		14.43	.260	2.60	2.0					198	-.026
265	20	768.7	.2	.1	.206	5.15		14.47	.257	2.57	2.0					197	-.026
270	25	768.7	.2	0	.202	5.05		14.59	.252	2.52	2.0					196	-.026
275	30	768.6	.1	.1	.205	5.12		14.49	.258	2.58	2.0					196	-.025
280	35	768.6	.1	0	.205	5.12		14.50	.255	2.55	2.0					195	-.025
285	40	768.5	0	.1	.200	5.00		14.64	.252	2.52	2.0					192	-.025
290																1976	.260
295														Total		5337	2.220
Tot													AVG	÷	58	264	.038

Time E/t	Time	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2nd burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent 2nd #17	Tube 1 #18	Tube 2 ΔT #19	Tube 3 ΔΔT #20
240	1755	365	412	358	398	287	662	758	78	91	219	37	62	37	767			
245	1800	362	408	352	396	286	660	749	78	91	219	37	62	37	772		361.2	-75.6
250	05	358	403	347	394	265	653	735	78	90	219	37	62	37	758			
255	10	354	398	344	392	263	641	726	77	90	218	37	62	37	750		354.2	-82.6
260	15	352	394	340	391	263	635	721	77	90	219	37	62	37	745			
265	20	349	390	335	389	282	629	714	77	90	220	37	62	37	738		349.0	-87.8
270	25	347	386	328	386	281	624	706	77	90	220	37	62	38	731		346.0	-90.8
275	30	344	381	323	386	279	617	701	77	90	221	38	62	38	725		342.6	-94.2
280	35	342	378	319	385	278	605	700	77	89	221	38	62	38	721		340.4	-96.4
285	40	338	373	313	382	275	596	693	76	88	219	37	61	37	711		336.2	-100.6
290		3511	3923	3359	3901	2819	6322	7203	772						ΔT			
295		28568	26776	20126	25739	17478	42973	58741	4444	Total					Start	436.8		
Tot		493	462	347	444	301	741	1013	77	AVG	÷58				End	336.2		ΔΔT -100.6

26676

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-1

Site: Myren Consulting, ~~Woodinville,~~ colville WA Date: 3/2/09 Analyte: CO_2

Source: Kuma Ashwood Run #: EPA 7

Zero Cyl #: TC 3AAM154 Conc. 00.0 % CO_2 Cyl Press: 1500 psi

Certified by: Oxarc Date: 11/12/07

Span Cyl #: AS90457 Conc. 12.5 % CO_2 Cyl Press: 1440 psi

Certified by: Matheson Tri Gas Date: 2/2/09

Analyzer: Make: Horiba Model: PIR-2000 SN: 607024

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

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

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

Pre Run Audit: By: A. T. Myren Time: 1247 Temp: 79 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.000	0.05453	+0.05453	+0.22
Span	50.0	.500	12.50	50.0	.500	12.4105	-0.0895	-0.72

Comments:

Post Run Audit: By: A. T. Myren Time: 1912 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	.0792	+0.0792	+0.32
Span	50.0	.500	12.50	49.5	.499	12.3858	-0.1142	-0.91

Comments:

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

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

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

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-3

Site: Myren Consulting, ~~Woodinville~~ Colville, WA Date: 3/2/09 Analyte: CO

Source: Kuma Ashwood Run #: EPA 7

Zero Cyl #: FC 3AAM154 Conc. 00.0 % CO Cyl Press: 1500 psi

Certified by: Oxarc Date: 11/12/07

Span Cyl #: AS90457 Conc. 2.0 % CO Cyl Press: 1440 psi

Certified by: Matheson Tri Gas Date: 2/2/09

Analyzer: Make: ~~Infra Red~~ Horiba Model: ~~702~~D MexA 311GE SN: ~~[illegible]~~ GE 30075

Range: 0 - 10.0% CO Analyzer Output: 0 - ~~[illegible]~~ 1.0 V.

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 5.0% CO
EPA Control Limits = ±2.5% of 5.0% CO = ± 0.125% CO

Pre Run Audit: By: A.T. Myren Time: 1247 Temp: 79 °F

Audit Results

Point #	Expected Response Meter	Expected Response DVM	Expected Response %	Actual Response Meter	Actual Response DVM	Actual Response %	± Conc. Difference	Δ %
Zero	00.0	00.0	00.0	0.00	.000	-.00443	-0.00443	-0.04
Span	2.00	.200	2.00	2.00	.200	2.0059	+0.00595	+0.30

Comments:

Post Run Audit: By: A.T. Myren Time: 1912 Temp.: 75 °F

Audit Results

Point #	Expected Response Meter	Expected Response DVM	Expected Response %	Actual Response Meter	Actual Response DVM	Actual Response %	± Conc. Difference	Δ %
Zero	00.0	00.0	00.0	0.00	.001	.00563	+0.00563	+0.06
Span	2.00	.200	2.00	1.99	.198	1.9858	-0.01416	-0.71

Comments:

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

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

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

Unit: Kuma Ashwood
Run: EPA-7
Date: 3/2/09
Technicians: ATM JRP PDG
WST6-Form3-Rev11/89

QUALITY CHECKS
WOODSTOVE DATA SHEET #16

Ambient = Tr: ______ °F T/C#30: ______ °F

Thermocouple Check (at ambient): T/C#1: — °F; T/C#2: 65.6 °F;

T/C #3: 62.9 °F;	T/C #4: 61.5 °F;	T/C #5: 61.8 °F;
T/C #6: 61.7 °F;	T/C #7: 61.3 °F;	T/C #8: 61.9 °F;
T/C #9: 62.2 °F;	T/C #10: 64.9 °F;	T/C #11: 60.1 °F;
T/C #12: 62.7 °F;	T/C #13: 63.3 °F;	T/C #14: 58.4 °F;
T/C #15: 62.2 °F;	T/C #16: 58.2 °F;	T/C #17: 64.8 °F;
T/C #18: — °F;	T/C #19: ____ °F;	T/C #20: ____ °F;
T/C #21: ____ °F;	T/C #22: ____ °F;	T/C #23: ____ °F;
T/C #24: ____ °F;	T/C #25: ____ °F;	T/C #26: ____ °F;

Comments: ______

Thermocouple Readout: Pretest Zero/Span Check and Calibration:

Zero (0°F): -0.1 °F	Adj to: — °F	Post Test Check Zero (0°F): 0.8 °F	% Difference +0.17
Span (2000°F): 2000.3 °F	Adj to: — °F	Span (2000°F): 2001.6 °F	+0.07

(Allowable % Difference = 1.5%. Use formulas on Woodstove Data Sheet #15 to calculate % Difference) In degrees absolute

Thermocouple Readout Pretest Linearity Check

0°F = 0.3 °F;	200°F = 201.8 °F;	400°F = 399.2 °F;
600°F = 601.5 °F;	800°F = 801.6 °F;	1000°F = 1000.8 °F;
1200°F = 1198.4 °F;	1400°F = 1399.4 °F;	1600°F = 1600.0 °F
1800°F = 1800.2 °F;	2000°F = 2000.3 °F	

Combustion Gas (CO_2, O_2, CO) Train Leak Check: Pre OK PDG ✓ Post ✓ OK PDG
Draft (Static) Guage Zero Check: Pre OK ATM Post ✓ OK PDG

Scale Check Pre (Wt, #'s): 771.3 - 766.3 = 5.0 lbs / 5.0 lbs = OK (ATM)
Post (Wt, #'s): 773.2 - 768.2 = 5.0 lbs / 5.0 lbs = OK (PDG)

Stack cleaned prior to the run: Yes____ No ✓
Tunnel cleaned prior to the run: Yes____ No ✓

EI HI

DILUTION TUNNEL CALCULATIONS

MYREN CONSULTING CERTIFICATION TEST DATA

1\25\09, Md=28.56, Bws=4% 6" Tunnel

File Name:	EPA 2
Manufacturer:	KUMA
Model Number:	ASHWOOD
Lab Name:	MYREN
Test Date:	2\17\09
Run Number:	EPA 2
Meter Box Y Factor:	1.0177
Barometric pressure (in):	28.224
Gas meter temp (ave):	**90**
delta H(avg):	**0.900**
Gas meter initial reading:	45.9000
Gas meter final reading:	158.4970
Front catch (acetone) mg:	9.4
first filter catch (mg):	11.2
second filter catch (mg):	-7.1
Tunnel Flow (Qsd) (dscfm)	**141.094**
Emission Rate(g/hr):	**1.099**
Emission Rate(M5H) :	**1.968**
Avg. of Delta P Sq. Roots:	**0.2073**
Vs (Avg.)(ft/min):	**849.029**
Tunnel Avg. Temperature (F):	**104.545**
Test time(min):	210
Fuel Load(lb. wet):	13.306
Wood moisture(%wet):	16.921
Burn rate(dry kg/hr):	**1.433**
Sample Volume (dscf)	**103.981**
Avg. Tunnel Static (-inch H2O):	**0.1740**
Room Blank Catch (mg/dscf):	0
Emission Factor (g/kg):	**0.7672**
Pitot Correction Factor:	0.9633
front filter number	708
back filter number	707
Beaker Number:	22
PRELIMINARY RESULTS	
FINAL RESULTS:	AUDITED
DATA SUMMARY	
MODEL:	ASHWOOD
RUN:	EPA 2
DATE:	2\17\09
DBR:	1.433
EMISSION RATE (g/hr)(M5H)	1.9685
EMISSION FACTOR (g/kg):	0.7672
AVG. % PROPORTIONALITY :	95.756

RUN TIME (min)	PITOT DELTAP (- INCH H20)	TNL TEMP (°F)	GAS METER RDG (ft3)	GAS METER TEMP (°F)	GAS METER DELTA H (in.H2O)	TUNNEL VELOCITY (ft/min)	PROP RATE (%)	dDGM vol std (ft3)	Tunnel Static (- Inch H2O)	SQUARE ROOT DELTA P	DRY GAS METER RDG (m3)
0	0.040	104	45.9000	73	0.900	849.72			0.167	0.2000	
10	0.045	116	51.3280	76	0.900	910.82	101.4	5.143	0.178	0.2121	
20	0.043	115	56.5780	79	0.900	889.57	99.1	4.947	0.171	0.2074	
30	0.043	116	61.8290	82	0.900	890.34	98.1	4.920	0.170	0.2074	
40	0.043	116	67.1200	85	0.900	890.34	97.8	4.931	0.171	0.2074	
50	0.043	115	72.4280	88	0.900	889.57	96.9	4.919	0.171	0.2074	
60	0.043	113	77.7470	90	0.900	888.02	96.3	4.912	0.173	0.2074	
70	0.043	111	83.0820	91	0.900	886.47	96.0	4.917	0.172	0.2074	
80	0.043	110	88.4500	92	0.900	885.69	96.2	4.939	0.173	0.2074	
90	0.043	107	93.8260	93	0.900	883.36	95.7	4.937	0.173	0.2074	
100	0.043	104	99.1990	94	0.900	881.02	95.1	4.926	0.175	0.2074	
110	0.044	103	104.5870	94	0.900	890.42	94.2	4.939	0.175	0.2098	
120	0.044	101	109.9890	94	0.900	888.84	94.2	4.952	0.177	0.2098	
130	0.045	100	115.3740	95	0.900	898.08	92.5	4.928	0.177	0.2121	
140	0.041	99	120.7610	94	0.900	856.47	97.2	4.938	0.177	0.2025	
150	0.043	97	126.1540	94	0.900	875.54	94.8	4.944	0.176	0.2074	
160	0.043	97	131.5480	95	0.900	875.54	94.5	4.936	0.177	0.2074	
170	0.043	96	136.9390	94	0.900	874.75	94.7	4.942	0.174	0.2074	
180	0.044	95	142.3290	94	0.900	884.07	93.5	4.941	0.177	0.2098	
190	0.043	95	147.7250	94	0.900	873.96	94.7	4.947	0.174	0.2074	
200	0.043	95	153.1200	94	0.900	873.96	94.7	4.946	0.174	0.2074	
210	0.044	95	158.4970	94	0.900	884.07	93.3	4.929	0.177	0.2098	
220			0.0000			0.00	0.0	0.000		0.0000	
230			0.0000			0.00	0.0	0.000		0.0000	
240			0.0000			0.00	0.0	0.000		0.0000	
250			0.0000			0.00	0.0	0.000		0.0000	
260			0.0000			0.00	0.0	0.000		0.0000	
270			0.0000			0.00	0.0	0.000		0.0000	
280			0.0000			0.00	0.0	0.000		0.0000	
290			0.0000			0.00	0.0	0.000		0.0000	
300			0.0000			0.00	0.0	0.000		0.0000	
310			0.0000			0.00	0.0	0.000		0.0000	
320			0.0000			0.00	0.0	0.000		0.0000	
330			0.0000			0.00	0.0	0.000		0.0000	
340			0.0000			0.00	0.0	0.000		0.0000	
350			0.0000			0.00	0.0	0.000		0.0000	
360			0.0000			0.00	0.0	0.000		0.0000	
370			0.0000			0.00	0.0	0.000		0.0000	
380			0.0000			0.00	0.0	0.000		0.0000	

METHOD 5G -1 **PARTICULATE SAMPLING DATA** **Rev. 2/09**

DATE: 2/17/09 **PAGE** 1 **OF** 2 **UNIT:** Kamco Ashwood **RUN:** EPA2

METER BOX: 456-P **METER Y:** 1.0177 **FILTER #'S: (F)** 708 **(R)** 707

.721 / .7215

PRE TEST LEAK CHECK: .0005 **CFM @** -16.1 **IN HG** **FILTER SIZE:** 110 **mm**

.559 / .560

POST TEST LEAK CHECK: .001 **CFM @** -15.5 **IN HG** **PROBE LENGTH** 21.5 **IN**

TIME		METER READING	PITOT		TUNNEL TEMP	METER TEMP	GAS METER	VAC
CLOCK	ELAPSED	(FT³)	ΔP	Pg	(°F)	(°F)	Δh	(in Hg)
1340	00	45.900	.040	-.167	104	73	0.90	0
50	10	51.328	.045	-.178	116	76	.90	0
1400	20	56.578	.043	-.171	115	79	.90	0
10	30	61.829	.043	-.170	116	82	.90	0
20	40	67.120	.043	-.171	116	85	.90	0
30	50	72.428	.043	-.171	115	88	.90	0
40	60	77.747	.043	-.173	113	90	.90	0
50	70	83.082	.043	-.172	111	91	.90	0
1500	80	88.450	.043	-.173	110	92	.90	0
10	90	93.826	.043	-.173	107	93	.90	0
20	100	99.199	.043	-.175	104	94	.90	0
30	10	104.587	.044	-.175	103	94	.90	0
40	120	109.969	.044	-.177	101	94	.90	0
50	30	115.374	.045	-.177	100	95	.90	0
1600	40	120.761	.041	-.177	99	94	.90	0
10	50	126.154	.043	-.176	97	94	.90	0
20	60	131.548	.043	-.177	97	95	.90	0
30	70	136.939	.043	-.174	96	94	.90	0
40	180	142.329	.044	-.177	95	94	.90	0
50	90	147.725	.043	-.174	95	94	.90	0

	BP
00	28.21
60	28.22
120	28.22
180	28.23
210	28.24

AVG. = 28.224

Pre Test Filter Check Weighing
F .6709
R .6781

End of Test Weight
F .6835 R .6722
.6702 .6777
.0133

METHOD 5G -1 **PARTICULATE SAMPLING DATA** Rev. 2/09

DATE: 2/17/09 PAGE 2 OF 2 UNIT: Kuma Ashwood RUN: EPA 2

METER BOX: 45G-P METER Y: 1.0177 FILTER #'S: (F) 708 (R) 707

PRE TEST LEAK CHECK: .0005 CFM @ -16.1 IN HG FILTER SIZE: 110 mm
.721 / .7215

POST TEST LEAK CHECK: .001 CFM @ 15.5 IN HG PROBE LENGTH 21.5 IN
.559 / .560

TIME		METER READING (FT³)	PITOT		TUNNEL TEMP (°F)	METER TEMP (°F)	GAS METER Δh	VAC (in Hg)
CLOCK	ELAPSED		ΔP	Pg				
1700	200	153.120	.043	-.174	95	94	.90	0
10	210	158.497	.044	-.177	95	94	.90	0
	20							
	30							
	40							
	50							
	60							
	70							
	80							
	90							
	00							
	10							
	20							
	30							
	40							
	50							
	60							
	70							
	80							
	90							

	BP		
00	28.21		
60	28.22		
120	28.22		
180	28.23		
210	28.24	AVG. =	

Pre Test Filter Check Weighing
F .6709
R .6781

End of Test Weight
F .6702 R .6777

MYREN CONSULTING, INC.

Dilution Tunnel Traverse Data with 8 Traverse Points

Unit: Kuma Ashwood
Run #: EPA 2
Date: 2/ 17 /09
Technicians: HTM JRP PDG
Rev 4/2/08

Point	Location	Δp	$\sqrt{\Delta p_{trav}}$	Δp	$\sqrt{\Delta p_{cent}}$	12 T_{trav}	12 T_{cent}	Pg
W-1	0.5"	.040	.2000			105		
2	1.5	.041	.2025			105		
Center	Center			.043	.2074		105	-.166
3	4.5	.044	.2098			105		
4	5.5	.034	.1844			104		
S-1	0.5	.036	.1897			104		
2	1.5	.041	.2025			104		
Center	Center			.042	.2049		104	-.168
3	4.5	.042	.2049			104		
4	5.5	.038	.1949			104		
	Totals		1.5887		.4123	835	209	-.334
	Average		.1986		.20615	104.375	104.5	-.167
	°R = (°F + 460)					564.375	564.5	

Ps = BP + (-Pg/13.6) = 28.21 + (-.167/13.6) = 28.198" Hg

LEAK CHECKS:

Pre Test: Pg Leg: ✓ GRP Velocity Head Leg: ✓ GRP

Post Test: Pg Leg: ✓ PDG Velocity Head Leg: ✓ PDG

MYREN CONSULTING, INC. EPA/ AS DATA SHEET # 5-2 PAGE 2 OF 2

DILUTION TUNNEL GAS VELOCITY & VOLUMETRIC FLOW RATE CALCULATIONS Rev 4/19/08

UNIT: Kuma Ashwood DATE: 2/17/09 RUN #: EPA 2 TECHNICIAN(S): ATM JTP PDG

Average Gas Velocity in the Dilution Tunnel Vstrav (EPA M2 EQN 2-9, ASTM E 2515-07 EQN 7)

(9) $V_{strav} = (85.49)(\underset{\{2\}}{0.99}\ cp)(\underset{\{2\}}{.1986}\ \overline{x}\ \sqrt{\Delta P}\ ''H_2O)\sqrt{\dfrac{\underset{\{0\}}{564.375}\ Ts\ °A}{(\underset{\{2\}}{28.198}\ Ps\ ''Hg)(28.56\ lb./\ lb.\ mole)}} = \underset{\{2\}}{14.0710}$ fps

(9A) $Vs = (\underset{\{2\}}{14.0710}\ fps)(60) = \underset{\{2\}}{844.261}$ fpm

Gas Velocity in the Center of the Dilution Tunnel - Vscent (EPA M2 EQN 2-9, ASTM E 2515-07 EQN 7)

(9) $V_{scent} = (85.49)(\underset{\{2\}}{0.99}\ cp)(\underset{\{2\}}{.20615}\ \overline{x}\ \sqrt{\Delta P}\ ''H_2O)\sqrt{\dfrac{\underset{\{0\}}{564.5}\ Ts\ °A}{(\underset{\{2\}}{28.198}\ Ps\ ''Hg)(28.56\ lb./\ lb.\ mole)}} = \underset{\{2\}}{14.6076}$ fps

(9A) $Vs = (\underset{\{2\}}{14.6076}\ fps)(60) = \underset{\{2\}}{876.453}$ fpm

EPA M5G1 Section 4.2.2, ASTM E 2515-07 EQN 1 Adjustment Factor for Center of Tunnel Pitot Tube Location

Fp = Vstrav/ Vscent = 14.0710 ÷ 14.6076 = 0.9633

Average Stack Gas Dry Volumetric Flow Rate - Qsd (EPA M2 EQN 2-10, ASTM E 2515-07 EQN 3)

(10) $Qsd = 3600(1 - 0.04\ Bws)(\underset{\{2\}}{14.071}\ fps)(\underset{\{3\}}{.1963}\ ft^2)[(528\ °A)(\underset{\{2\}}{28.198}\ Ps\ ''Hg)/(\underset{\{0\}}{564.375}\ T_s\ °A)(29.92''\ Hg) =$

$\underset{\{1\}}{8,416,700}$ dscfhr (or dscfh)

(10A) $\underset{\{1\}}{8,416,700}$ dscfhr ÷ 60 = $\underset{\{1\}}{140,278}$ dscfmin (or dscfm)

Note: Number in { } under blank lines denotes number of decimals to be used. If a blank calls for an answer already calculated, use the number of decimals previously specified for that answer.

WST5-Form9,Pg2,Rev1/90

WOODSTOVE DATA SHEET #4-1: INITIAL FILTER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date 1-20-09 Time 1149 By PDG Front Half X Back Half X

Manufacturer: Pall P/N 60115 Size: 110 Lot.No.: 70726 Grade: A/E Glass

Filter #	First Wt	2009 Date	Time	By	Second Wt	Date	Time	By	Third Wt	2009 Date	Time	By
700	.6873	1-22	1331	GRP	.6877	1-23	1417	PDG				
701	.6871		1330	GRP	.6878		1419	PDG	.6877	1.26	1421	GRP
702	.6816		1329	GRP	.6825		1420	PDG	.6824	1.26	1420	GRP
703	.6761		1328	GRP	.6762		1421	PDG				
704	.6727		1327	GRP	.6732		1422	PDG				
705	.6833		1326	GRP	.6837		1423	PDG				
706	.6946		1325	GRP	.6948		1424	PDG				
707	.6773		1324	GRP	.6777		1425	PDG				
708	.6701		1323	GRP	.6702		1426	PDG				
709	.6799		1322	GRP	.6809		1427	PDG	.6806	1.26	1419	GRP
710	.6587		1321	GRP	.6590		1428	PDG				
711	.6654		1320	GRP	.6656		1429	PDG				
712	.6688		1319	GRP	.6692		1430	PDG				
713	.6864		1318	GRP	.6866		1431	PDG				
714	.6651		1318	GRP	.6655		1432	PDG				
715	.6741		1317	GRP	.6744		1433	PDG				
716	.6592		1316	GRP	.6590		1434	PDG				
717	.6531		1315	GRP	.6536		1435	PDG				
718	.6621		1314	GRP	.6623		1436	PDG				
719	.6769		1313	GRP	.6769		1437	PDG				
720	.6627		1312	GRP	.6628		1438	PDG				
721	.6567		1311	GRP	.6569		1439	PDG				
722	.6539		1310	GRP	.65340		1440	PDG				
723	.6552		1309	GRP	.6552		1441	PDG				
724	.6655		1308	GRP	.6656		1442	PDG				

Checked by A.T. Myers Date: 1/27/09 Time 1632

QA REWEIGH

Filter #	WT	Date	Time	By
703	.6761	1/27/09	1639	ATM
708	.6703		1640	ATM
715	.6749		1642	ATM

Post	1-22	1-23	1-26
0.0000	0.0000	0.0000	0.0000
100.0000	99.9994	99.9993	99.9993

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
57	72	38	1-22-09	1138	ATM
60	75	33	1-23-09	1150	PDG
56	76	25	1-26-09	1359	GRP
58	72	31	1/27/09	1530	PDG

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date: 01.26.09 Time: 15:38 By: JRP

Beaker #	First Wt	2009 Date	Time	By	Second Wt	2009 Date	Time	By	Third Wt	Date	Time	By
20	73.3181	1/27	1532	PDG	73.3176	1.29	1459	JRP		1/30		
21	71.0021		1534	PDG	71.0018		1458	JRP				
22	71.8343		1535	PDG	71.8338		1457	JRP				
23	70.7390		1536	PDG	70.7389		1455	JRP				
27	72.3310		1538	PDG	72.3307		1500	JRP				
31	69.6672		1539	PDG	69.1669		1501	JRP				
32	53.6002		1541	PDG	53.5993		1502	JRP	53.5998		1305	PDG
37	53.7267		1542	PDG	53.7262		1504	JRP				
38	53.2525		1544	PDG	53.2516		1505	JRP	53.2520		1308	PDG
39	53.1509		1545	PDG	53.1493		1506	JRP	53.1496		1311	PDG
40	53.4626		1547	PDG	53.4622		1507	JRP				
41	52.8371		1549	PDG	52.8367		1508	JRP				
42	53.8699		1550	PDG	53.8692		1509	JRP	53.8696		1302	PDG

Checked By: [signature] Date: 2/1/09 Time: 1210

QA REWEIGH

Beaker #	WT	Date	Time	By
20	73.3181	2/1/09	1215	ATM
31	69.6671		1217	ATM
42	53.8699		1219	ATM

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	2009 Date	Time	By
55	72	31	1/27	1530	PDG
58	77	29	1.29	1436	OMP
60	72	49	1/30	1256	PDG
58	74	37	2/1	1200	ATM

	1/27	1.29	1/30	2/1
PDH	0.0000	0.0000	0.0000	0.0000
	99.9994	100.0002	99.9995	99.9992

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Blank done 12/6/07

Into Dessicator: Date: 10/12/07 Time: 0801 By: GRP

Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
22	71.8343	10/22/07	1358	GRP	71.8332	11/10/07	1938		71.8330	11-11-07	1748	Jm
24	73.2192		1400	GRP	73.2190	11/10/07	1940		73.2193	11-11-07	1746	Jm
25	72.6516		1401	GRP	72.6512	11/10/07	1944	← Blank				
X 26	71.7895		1403	GRP	71.7888	11/10/07	1939		71.7886	11-11-07	1747	Jm
27	72.3316		1402	GRP	72.3314	11/10/07	1945					
28	70.5979		1404	GRP	70.5975	11/10/07	1941		70.5977	11-11-07	1745	Jm
39	53.1508		1405	GRP	53.1500	11/10/07	1942					
37	53.7237	11/10/07	1945	AM	53.7238	11/11/07	1743	Jm				

Checked By: ______ Date: ______ Time: ______

QA REWEIGH

Beaker #	WT	Date	Time	By
27	72.3315	11-11	1740	Jm
25	72.6515	11-11	1741	Jm
39	53.1509	11-11	1744	Jm

Post weighing 2nd
0.00004

LSD
0.0000

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
57	68	50	10/22/07	1344	GRP
			11/10		

WST5-Form9 Rev4/90
Unit Kuma Ashwood
Run # EPA 2
Date: 2/17/2009

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

SS #1

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	2009 Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
22	✓	2/20	1021	PDG	71.8432	2/21	1533	ATM	71.8448	2/22	1231	Jnc	71.8436	2/23	1417	PDG
					71.8432	2/24	1000	ATM								

FINAL FILTER WEIGHTS

	Filter #	Into Dessic	2009 Date	Time	By	First	Date	Time	By	Second	2009 Date	Time	By	Third	Date	Time	By
F	708	.6835	2/17	1805	ATM	.6827	2/18	1816	ATM	.6815	2-19	1317	JRP	.6814	2/20	1043	PDG
R	707	.6722	2/17	1805	ATM	.6709	2/18	1815	ATM	.6706	2-19	1318	JRP				

Lots of R. Filter stayed on Frit

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By

Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	2009 Date	Time	By	WB	DB	%RH
1	2/18	1800	ATM	55	70	36
2	2/19	1248	JRP	56	73	32
3	2/20	1018	PDG	57	74	33
4	2/22	1222	ATM	47	59	37
5	2/23	1406	PDG	50	70	48

SCALE ROOM ENVIRONMENTAL CONDITIONS

6	2/24	0453	ATM	59	76	35
7						
8						
9						

Comments

Acetone
Lot #
041648

Tare 72.6512

Blank
done
12/18/07

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

WST5-Form9, Pg1, Rev4/90
Unit Kuma Ashwood
Run # EPA-2
Date: 2/17/09

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	2007 Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
25	✓	12/12	1546	JRP	72.6508	12/13	1342	JRP	72.6511	12/14	1347	Jn				

FINAL FILTER WEIGHTS

Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By

Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	2007 Date	Time	By	WB	DB	%RH
1	12/13	1307	JRP	55	73	29
2	12/14	1321	JRP	57	75	31
3						
4						

SCALE ROOM ENVIRONMENTAL CONDITIONS

6						
7						
8						
9						

Comments

WOODSTOVE DATA SHEET 4-4 SCALE QC RECORD SHEET

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

FROM: 9/27/2007
THROUGH: 12/7/2007

Level	Recalibrated	130 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	129.9998	99.9998	10.0000	1.0000	0.1000	0.0199	9/27/07	1402	GRP	55	67	45
✓	Y	129.9995	99.9996	10.0001	1.0000	0.1000	0.0200	9/28/07	1335	GRP	57	69	46
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0200	10/1/07	1505	ATM	58	70	48
✓	N	129.9995	99.9996	10.0000	1.0001	0.1000	0.0199	10/2/07	1611	GRP	56	68	46
✓	N	129.9997	99.9997	9.9999	1.0001	0.1000	0.0199	10/3/07	1122	GRP	56	68	46
✓	N	129.9996	99.9996	10.0000	1.0000	0.0999	0.0199	10/4/07	1225	GRP	55	67	45
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	10/5/07	0750	GRP	51	62	45
✓	N	129.9997	99.9997	9.9999	1.0000	0.1000	0.0199	10/5/07	1513	GRP	56	69	43
✓	Y	129.9996	99.9996	10.0000	1.0001	0.1001	0.0200	10/9/07	1505	ATM	58	71	44
✓	N	129.9996	99.9997	10.0000	1.0001	0.1001	0.0200	10/12/07	1259	ATM	58	70	48
✓	Y	129.9995	99.9996	9.9999	1.0000	0.1000	0.0199	10/22/07	1344	GRP	57	68	50
✓	Y	129.9996	99.9997	9.9999	1.0000	0.1000	0.0199	10/29/07	1338	GRP	53	63	50
✓	N	129.9995	99.9995	10.0000	1.0000	0.1000	0.0200	10/30/07	0933	ATM	56	70	40
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1000	0.0199	10/30/07	1457	GRP	55	70	36
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	10/31/07	1528	GRP	57	75	30
✓	Y	129.9996	99.9996	9.9999	1.0000	0.0999	0.0199	11/2/07	1238	GRP	52	67	33
✓	Y	129.9996	99.9996	10.0000	1.0001	0.1000	0.0199	11/5/07	0730	GRP	57	73	35
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1001	0.0201	11/9/07	1550	ATM	58	70	48
✓	N	129.9996	99.9997	10.0000	1.0000	0.1000	0.0200	11/10/07	1835	ATM	58	71	44
✓	Y	129.9997	99.9997	9.9999	1.0000	0.1000	0.0199	11/11/07	1810	ATM	55	69	39
✓	N	129.9997	99.9996	9.9999	1.0000	0.1000	0.0199	11/12/07	0822	GRP	54	67	41
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	11/13/07	1226	ATM	58	72	41
✓	N	129.9998	99.9997	9.9999	0.9999	0.1000	0.0200	11/14/07	1710	GRP	58	73	39
✓		QC Services Audit 11/14/07											
✓	Y	129.9997	99.9997	10.0000	1.0000	0.1000	0.0200	11/15/07	1358	ATM	59	72	45
✓	N	129.9996	99.9996	9.9999	0.9999	0.1000	0.0200	11/16/07	1600	GRP	58	71	44
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	11/18/07	1758	ATM	60	74	43
✓	Y	129.9997	99.9997	10.0000	1.0000	0.1001	0.0200	11/19/07	1143	ATM	56	70	40
✓	Y	129.9995	99.9996	10.0000	1.0000	0.1000	0.0199	11/20/07	1416	GRP	54	69	35
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	11/27/07	1110	ATM	57	70	44
✓	N	129.9995	99.9996	10.0000	1.0000	0.1000	0.0199	12/3/07	0730	GRP	55	69	40
✓	N	129.9996	99.9996	10.0000	1.0000	0.0999	0.0200	12/6/07	1125	ATM	54	67	44
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/7/07	1348	GRP	55	69	40

ATM

WOODSTOVE DATA SHEET 4-4 SCALE QC RECORD SHEET

FROM: 12/8/07
THROUGH: 2/3/08

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

Level	Recalibrated	130 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/8	1215	ATM	57	73	35
✓	N	129.9996	99.9996	10.0000	1.0000	0.1001	0.0200	12/8	1910	ATM	57	72	38
✓	N	129.9997	99.9996	10.0000	1.0000	0.1000	0.0199	12/9	1935	ATM	55	72	31
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/10	1953	ATM	56	72	34
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/11	1618	GRP	57	76	28
✓	N	129.9997	99.9996	10.0000	1.0000	0.0999	0.0199	12/12	1505	GRP/ATM	56	74	30
✓	N	129.9996	99.9996	9.9999	0.9999	0.1000	0.0199	12/13	1307	GRP	55	73	29
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	12/14	1321	GRP	57	75	31
✓	N	129.9998	99.9998	9.9999	1.0001	0.1000	0.0199	12/15	1602	GRP	57	75	31
✓	Y	129.9996	99.9997	9.9999	1.0000	0.1000	0.0199	12/17	0817	GRP	55	73	29
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/18	0853	GRP	58	75	34
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/19	0812	GRP	55	72	31
✓	Y	129.9995	99.9996	10.0000	1.0001	0.0999	0.0199	12/20	0916	GRP	57	71	41
✓	Y	129.9998	99.9997	10.0000	1.0000	0.1000	0.0199	12/21	1085	ATM	55	70	36
✓	N	129.9997	99.9996	10.0000	1.0000	0.10000	0.0200	12/22	1434	[illegible]	54	66	44
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/23	0915	ATM	57	70	44
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	12/26	1230	ATM	57	70	44
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0200	12/27	1030	ATM	56	72	34
✓	N	129.9998	99.9997	9.9999	1.0000	0.1000	0.0200	1/8/08	1342	GRP	54	68	38
✓	N	129.9997	99.9997	10.0000	1.0001	0.1000	0.0200	1/9/08	0742	GRP	55	70	36
✓	N	129.9998	99.9998	10.0000	1.0000	0.1000	0.0199	1/11/08	1040	ATM	59	73	42
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1000	0.0199	1/16/08	1221	GRP	51	72	18
✓	N	129.9999	99.9998	10.0000	1.0000	0.1000	0.0199	1/17/08	1237	GRP	56	71	37
✓	N	129.9998	99.9998	10.0000	1.0000	0.0999	0.0200	1/18/08	1116	GRP	56	71	37
✓	Y	129.9995	99.9996	9.9999	1.0001	0.1000	0.0199	1/21/08	1426	GRP	56	72	34
✓	N	129.9995	99.9996	10.0000	1.0001	0.1000	0.0199	1/22/08	1513	GRP	56	71	37
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	1/23/08	0805	GRP	54	69	36
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	1/24/08	0758	GRP	54	70	33
✓	N	129.9998	99.9997	10.0000	1.0000	0.1000	0.0199	1/24/08	1450	GRP	56	71	37
✓	N	129.9997	99.9996	10.0000	1.0000	0.1000	0.0200	1/31/08	1505	GRP	55	69	38
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	2/1/08	1029	GRP	54	69	36
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	2/2/08	1620	ATM	58	72	41
✓	N	129.9996	99.9997	10.0000	1.0001	0.1000	0.0200	2/3/08	1710	ATM	57	70	44

WOODSTOVE DATA SHEET 4-4 ANALYTICAL BALANCE QC RECORD SHEET

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

FROM: 12/20/08
THROUGH: 2/17/09

Level	Recalibrated	140 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	12/20/08	1430	ATM	58	72	42
✓	N	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	12/23/08	1057	JRP	60	76	38
✓	N	139.9994	99.9994	9.9999	1.0001	0.1000	0.0200	12/24/08	1019	ATM	59	72	45
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0200	12/26/08	1142	ATM	59	72	45
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0200	12/28/08	1050	ATM	60	75	37
✓	N	139.9994	99.9994	10.0000	.9999	0.1000	0.0199	1/05/09	1157	PDG	58	75	34
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	1/6/09	1845	ATM	60	75	37
✓	N	139.9995	99.9996	9.9999	1.0000	0.1000	0.0199	1/7/09	1530	JRP	58	70	48
✓	N	139.9994	99.9994	9.9999	.9999	0.1000	0.0199	1/8/09	1356	PDG	60	72	49
✓	Yes	139.9993	99.9994	9.9999	1.0000	0.1000	0.0200	1/09/09	1053	PDG	58	72	42
✓	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	1/11/09	1128	JRP	55	72	31
✓	Yes	139.9994	99.9995	9.9999	1.0000	0.1000	0.0199	1/12/09	0845	PDG	59	75	38
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0200	1/13/09	0825	JRP	58	74	37
✓	yes	139.9993	99.9994	9.9999	0.9999	0.1000	0.0199	1-14-09	1212	PDG	57	72	28
✓	NO	139.9993	99.9993	9.9999	1.0000	0.0999	0.0199	1/14/09	1420	JRP	59	75	37
✓	NO	139.9992	99.9993	10.0000	1.0000	0.0999	0.0199	1-15-09	1128	JRP	58	74	37
✓	yes	139.9994	99.9995	9.9999	0.9999	0.1000	0.0199	1-20-09	0950	PDG	58	74	37
✓	no	139.9993	99.9994	10.0000	0.9999	0.1000	0.0199	1-20-09	1230	PDG	56	71	37
✓	NO	139.9993	99.9993	9.9999	1.0000	0.0999	0.0199	1-20-09	1613	JRP	57	73	35
✓	No	139.9994	99.9994	9.9999	1.0000	0.1001	0.0200	1/22/09	1138	ATM	57	72	38
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	1/23/09	1150	PDG	58	75	33
✓	YES	139.9992	99.9993	10.0000	1.0000	0.0999	0.0200	1/26/09	1359	JRP	56	76	25
✓	no	139.9994	99.9995	10.0000	1.0000	0.1000	0.0199	1/27/09	1530	PDG	55	72	31
✓	No	139.9993	99.9993	10.0000	1.0001	0.1001	0.0200	1/28/09	1452	ATM	61	75	41
✓	YES	139.9993	99.9994	10.0000	1.0000	0.1000	0.0199	1-29-09	1436	JRP	58	77	29
✓	no	139.9995	99.9995	9.9999	0.9999	0.1000	0.0199	1/30/09	1256	PDG	60	72	49
✓	Yes	139.9993	99.9994	9.9999	1.0000	0.1000	0.0199	2/1/09	1200	ATM	58	74	37
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	2/2/09	1350	JRP	58	77	29
✓	yes	139.9995	99.9996	9.9999	1.0000	0.1000	0.0199	2/5/09	1118	PDG	59	72	45
✓	NO	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	2/6/09	1150	JRP	57	74	33
✓	No	139.9994	99.9994	10.0000	1.0001	0.1000	0.0200	2/9/09	1015	ATM	49	70	19
✓	NO	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	2/16/09	1551	PDG	61	78	36
✓	NO	139.9993	99.9994	9.9999	1.0000	0.1000	0.0200	2/17/09	1439	JRP	56	72	35

WOODSTOVE DATA SHEET 4-4 ANALYTICAL BALANCE QC RECORD SHEET

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

FROM: 2/10/09
THROUGH:

Level	Recalibrated	140 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
Y	Y	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	2/10/09	1800	ATM	55	70	36
Y	Y	139.9993	99.9994	9.9999	1.0000	0.1000	0.0199	2-19-09	1248	JRP	56	73	32
Yes	Y	139.9993	99.9994	9.9999	0.9999	0.1000	0.0199	2/20/09	1018	PDG	57	74	33
Yes	Y	139.9993	99.9994	10.0000	1.0000	0.1000	0.0200	2/21/09	1519	ATM	60	77	35
Yes	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	2/22/09	1222	ATM	47	59	37
Y	Yes	139.9994	99.9994	9.9999	0.9999	0.1000	0.0199	2/23/09	1406	PDG	58	70	48
Yes	No	139.9994	99.9994	9.9999	1.0000	0.1000	0.0200	2/24/09	0953	ATM	59	76	35
Yes	Yes	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	2/25/09	1123	PDG	60	76	38
Yes	Yes	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	2-26-09	1258	JRP	55	70	36
YES	YES	139.9993	99.9993	9.9999	1.0001	0.1001	0.0200	2/29/09	1330	ATM	57	74	33
Yes	Yes	139.9995	99.9995	9.9999	0.9999	0.1000	0.0199	3/3/09	1431	PDG	59	76	35
Yes	NO	139.9993	99.9995	9.9999	1.0000	0.1000	0.0199	3/4/09	1556	JRP	56	70	40
Yes	No	139.9994	99.9994	9.9999	1.0001	0.1001	0.0200	3/5/09	1350	ATM	60	75	40
Yes	No	139.9993	99.9993	9.9999	1.0000	0.1000	0.0200	3/7/09	0850	ATM	57	71	41
Yes	Yes	139.9993	99.9993	10.0000	1.0001	0.1000	0.0200	3/8/09	1323	ATM	55	70	36
Yes	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	3/10/09	1212	PDG	50	75	10

Woodstove Particulate
Catch Processing Sheet
Woodstove Data Sheet #5
EPA M5G-1

Unit : Kuma Ashwood
Run: EPA 2
Date: 2/17/09
Technicians: ATM
Revised 1/16/98-Data Sheet #5

Filters

Filter # (Front) 708 Beaker # 22
Final Wt. .6814 g Ml 55
Tare Wt. .6702 g Desc. Acetone
Net Wt. .0112 g

Final Wt. 71.8432 g
Tare Wt. 71.8338 g
Net Wt. .0094 g

Filter # (Rear) 707 Beaker # ______
Final Wt. .6706 g Ml ______
Tare Wt. .6777 g Desc. ______
Net Wt. -.0071 g

Final Wt. ______ g
Tare Wt. ______ g
Net Wt. ______ g

Acetone Blank Calculation: Blank Date: 12/8/07

Blank Beaker # 25 Final Wt. 72.6511 g
Ml 50 Tare Wt. 72.6512 g
Desc. Acetone Net Wt. -0.0001 g = 0.0000

0.0000 g ÷ 50 ml = 0.00000 g/ml

Blank Residue Value Calculation:

0.00000 g/ml acetone X 55 ml acetone = 0.0000 g
Blank Residue Value

Total Particulate Catch Calculation

Filter: .0112 g
Filter: -.0071 g
Beakers: .0094 g -- 0.0000 g = .0094 g
Total Catch Blank Residue Value

Total Catch = .0135 g

Unit Kuma Ashwood
Run # EPA 2
Date 2/17/09
Technician ATM JRP PDG
WST6-Form1,Rev8/96

MISCELLANEOUS TEST DATA
WOODSTOVE DATA SHEET #8

Useable Firebox Dimensions: See QC Section Useable Volume: 2.094 ft^3

Dilution Tunnel Draft (If applicable): Start .000 Stop .000 "H_2O

Test Chamber Air Velocity: Start: 00.0 Stop: 00.0 Avg: 00.0 ft/MIN

Wet Bulb/ Start: WB: 59 °F DB: 77 °F 1.05 % Amb Moisture 33 %RH
Dry Bulb Stop: WB: 59 °F DB: 77 °F 1.05 % Amb Moisture 33 %RH
$\bar{X}$ = 1.05 % Ambient Moisture $\bar{X}$ = 33.0 % Relative Humidity (RH)

Empty Stove Wt: 440.2 lbs.

Empty Stove Wt with Stack (Inc. Oil Seal) Wet: 763.8 lbs. Dry: 763.8 lbs.

Empty Stove Wt with Stack and Ash Ash: — lbs. Total: — lbs.

Kindling Wt. Total 5.0 lbs. Paper: 0.3 lbs. Wood: 4.7 lbs.

Pre Burn Fuel Wt. 10.952 + 13.668 + 10.632 Total: 35.252 lbs.

Total Kindling and Pre Burn Fuel Wt 40.252 lbs.

Coal Bed Wt-lbs: Range (3.3 - 2.7) ~~763~~ 1-766.5 lbs. Actual: 3.1 766.9 lbs.

Allowable Amount of Charcoal that can be removed:

Coal Bed Wt. Range (3.3 Upper Wt. + 2.7 Lower Wt. /2) X .25 = 0.7 lbs.

Test Fuel Wt-lbs: Ideal 14.7 lbs. Range: 16.1-13.2 lbs. Actual: 13.306 lbs.

Test Fuel Size (pcs.) (.75 x 1.5 x 5" Flanges) 1.314 lbs 16 Pcs.

2 x 4's x 16.0 " 3 Pcs 5.978 lbs. 44.93 %

4 x 4's x 16.0 " 2 Pcs 7.328 lbs. 55.07 %

5.0143 Kg.

Est. Dry Burn Rate (Kg/Hr.) $\frac{13.306 - (13.306 \times .1692)}{2.2046} \times \frac{60}{210}$ = 1.4327 Est. Dry Burn Rate (Kg/Hr)

Est EPA Heat Output (HO_E) (Avg BTU's/Hr) (19,140) X $\frac{63}{100}$ x 1.4327 = 17,275 Est Heat Output (HO_E) BTU's/Hr

Comments:
160 mins = 1.880
235 " = 1.280
240 " = 1.254

Stove Operating Data
Woodstove Test Data Sheet #9
Cold Start

Unit: Kuma Ashwood
Run: EPA 2
Date: 2/17/09
Technician(s): AJ Myren
Data Sheet#9–Rev 1/98-Pg.2

Fire Started: 0956

Warm up and Preburn: Primary Air: Wide open from ignition until the start of preburn when the primary air control(s) was (were) adjusted to the run setting of .728" orifice. At the run setting until the start of the test. 2.736" on threaded rod

Secondary Air: No Controls, Naturally drafted

Secondary Burn Bypass: N/A

Charcoal Bed Preparation: Broke up, raked and leveled the coal bed prior to the addition of each warm up/pre burn fuel charge. Starting 1130 before the start of the test, broke up, raked and leveled the coal bed. In stove for 26 seconds.

Test: Door wide open during loading 1 min 02 sec, then closed.

Primary Air: Wide open from the start of the test (0:00) until 4:45. Adjusted to the run setting of .728" between 4:45 and 5:00. At the run setting of .728" at 5:00 into the run.

Secondary Air: No Controls, Naturally drafted.

Secondary Burn Bypass: N/A

Fan: ON/OFF during the warm up, ON/OFF Low during the preburn, ON/OFF at the start of test, ON/OFF for ~~the first~~ 30 minutes of test, ON/OFF Low at 30 minutes into test, ON/OFF for the rest of test.

Test Run Anomalies:

Unit Kuma Ashwood
Run # EPA 2
Date 2/17/109
Technician ATM
Page 1 of 4
WST7-Form2-A, Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-1

Wood Data: Kindling: A mix of the below grades

	Size	Mill	Grade	Species
Pre Burn	2X4	Forest Grove	#2, Std & Btr	D.Fir, Sfc Grn
Test Fuel	2X4	Forest Grove	#2, Std & Btr	D.Fir, Sfc, Grn
	4X4	Forest Grove	No.1	D.Fir, Sfc, Grn

All grades WCLB Rules unless otherwise noted.

Warm up Information:

1st Warm up/Pre Burn Fuel charge (10.952 lbs) added at 1010.
2nd Warm up/Pre Burn Fuel charge (13.668 lbs) added at 1059.
3rd Warm up/Pre Burn Fuel charge (10.632 lbs) added at 1209.
4th Warm up/Pre Burn Fuel charge (____ lbs) added at ____.
5th Warm up/Pre Burn Fuel charge (____ lbs) added at ____.
6th Warm up/Pre Burn Fuel charge (____ lbs) added at ____.
7th Warm up/Pre Burn Fuel charge (____ lbs) added at ____.
8th Warm up/Pre Burn Fuel charge (____ lbs) added at ____.

1st Rick 4-12" 4-16" 2X4's 3rd Rick 4-12", 3-16" 2X4's
2nd Rick 8-16" 2X4's

The coals were scooped out of the stove immediately prior to adding the 3rd pre burn/warm up fuel charge. The stove lost 0 lbs. 2.0 lbs. of coals were put back in the stove after the scoop.

All pre burn/warm up fuel pieces were either 12 or 16 inches long. All preburn pieces/fuel charges were "ricked" in the stove. The pieces in the bottom layer in each rick contained 2 pcs that were 12 or 16 inches long and were loaded flat and perpendicular to the door. The pieces in the second layer in each rick were loaded on their side (edge) approximately parallel to the door and contained 3 or 4 pcs 16 inches long. The third layer (and fourth layer if present) was loaded flat, perpendicular to the door and contained 2 pcs 12 or 16 inches long. The majority of the pieces in each rick were in the second layer which had an approximate 0.5-1.0" space between pieces. (The loading directions indicate the direction of the longest dimension on each piece relative to the loading door opening.) Each pre burn/warm up fuel charge normally weighs within the weight range allowed for the actual test fuel charge

Unit	Kuma Ashwood
Run #	EPA 2
Date	2/17/09
Technician	ATM
Page	2 of 4

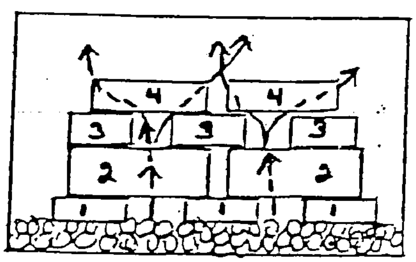
WST7-Form2-A, Rev 6/90

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-2

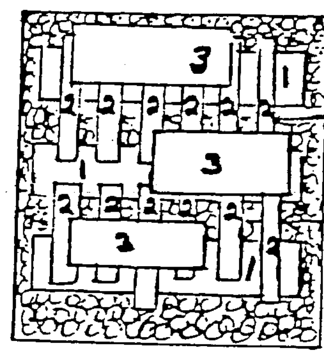
Warm up Information (cont.):

Each warm up/preburn fuel charge was ricked in exactly (as much as possible) the same manner and the weight of each rick was usually within the allowable weight range for the test fuel charge. The physical arrangement and alignment of each rick was designed to accomplish three (3) things: (1)The bottom layer was nestled firmly into the coal bed and was as close to being level with the bottom of the stove as possible, thus providing a stable loading platform for the rest of the rick, keeping it in a ricked state (as opposed to a col- lapsed or fallen down state) untill the rick reached the charcoal stage and sags or collapses of its own accord. (2) It enhances the flow of primary air through the ricked preburn fuel charge, for the primary air would flow through the spaces between the pieces in the first layer and then up through the spaces between the pieces in the second, third and, if present, fourth layers. (3) It maximized, as much as possible, the surface to volume ratio of each preburn fuel charge, thereby allowing the fire immediate access to as much wood surface as possible and, thereby, insuring uniform charcoalization. All three of these enhance combustion and so get the stove as hot as possible during the warm up period, therby maximizing the amount of heat (BTU's) stored in the stove. The actual preburn was not started until the stove surface temperatures had maximized and stabilized, thus indicating that the amount of heat stored in the stove had peaked. For this stove, the thermal storage was monitored using the Stove Top T/C surface temperature(s) and the peak value(s) obtained were 1094 °F.

944
1094



Front View



Top View

The arrows indicate the direction of the air flow through the rick.

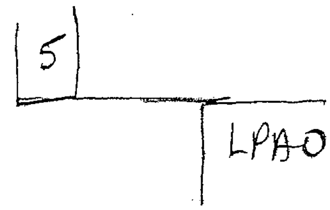
The primary air was adjusted to the run setting of 0.718" open 6.0 lbs above the upper charcoal bed weight.

Unit Kuma Ashwood
Run # EPA 2
Date 2/17/09
Technician ATM
Page 3 of 4
WST5-Form2-Rev11/89

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-3

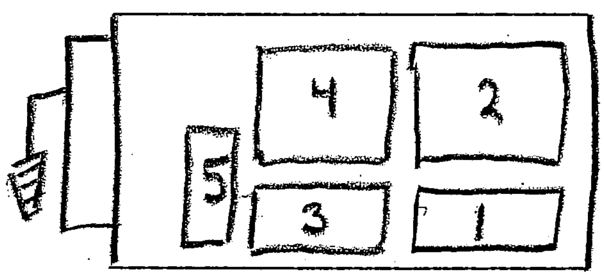
Additional Comments: Test Start Sequence: (1) Turned Fan OFF, (2) Adjusted Primary Air Control to Wide Open, (3) Opened door (4) Loaded Fuel (5) cleared coals away from in front of the LPAO (6) closed door,

TOTAL ElapsED Time: 1102
Photo @ 1:40



Test Fuel Charge Loading Information:

Test Fuel Charge and Loading Sequence Diagram



SIDE of stove view

4 X 4's: 2,4

2 X 4's: 1,3 & 5

Loading Sequence: 1,2,3,4 & 5 last

Driest Pcs in Load 3,5

Loaded the test fuel charge on an essentially level, Medium sized, average coal bed (in appearance, color and temperature for a Med Hi burn rate. Load: 1:02 Ignition: N1:00

1:10 Vertical Column of Flame (VC) up to baffle
1:40 Photo taken
1:25 2nds igniting
2:10 Front Top Edge Pc 4 igniting
3:00 Seconds Full Width of 4 - especially on L end
3:25 10.90/.61 (% CO_2/%CO) Gas Balance
4:45 - 5:00 Primary Air Control slowly adjusted to the run setting.
5:00 Flames decreased, Maintained a hot pocket of coals under pc 5 with a Vertical column of flame (VC) up to baffle. 13.05/.48 ML/L smoke. The back of the front tube was orange at 5:00.

Unit Kuma Ashwood
Run # EPA 2
Date 3/17/09
Technician ATM

WST5-Form2-Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-4

Additional Comments:

6:15 Secondaries above both Right and Left ends of pc 4, with more on right end.

7:55 Back of front tube no longer orange, but tube is igniting in the center. Secondaries still the full width of pc 4.

26:22 Out of Balance - 16.— /1.70. Stackitis from pc 5 - pc 5 about burnt thru. Lots of velocity in the Secondaries.

30:00 Fan On Low 17.03/1.72

30:19 16.93 /1.62

Unit: Kuma Ashwood
Run: EPA 2
Date: 2/17/09
Technician: AVM SRP PDG

FUEL MOISTURE
WOODSTOVE TEST DATA SHEET #10

WST1-Form7-Rev11/89

5kg. = 11.024 lbs. 1 kg. = 2.204 lbs

Room Temperature: 64.3 °F   Correction Factor: +0.5

NOTE: Record readings to the nearest 0.5% moisture
Uncor Values are corrected for temperature: Yes ✓ No
Time Test Fuel Moisture Readings taken at: 10:45
Calibration Checks: X — Y — 12.0 11.9 22.0 22.2

	Pc #	Dimen	Use	Top Uncor	Top Cor	Bottom Uncor	Bottom Cor	Side Uncor	Side Cor	Piece Avg Corrected
	1	3 pcs	K	7.25	7.575	8.5	8.95	8.25	8.675	8.400
	2									
	3									
	4	2x4-8'	P	21.5	23.1	19.5	20.9	18	19.2	21.067
	5	↓	↓	18	19.2	18	19.2	18.5	19.8	19.400
	6			18.5	19.8	18.5	19.8	19	20.9	20.167
	7			20	21.4	21.5	23.1	20.5	22.0	22.167
	8			21.0	22.6	20.0	21.4	20.0	21.4	21.800
	9									104.601
	10	"								
20	11	2X4-16.0	T	18	19.2	18.5	19.8	18.5	19.8	19.600
2.032	12	↓	↓	20	21.4	20	21.4	20.5	22.0	21.600
	13			18	19.2	18.5	19.8	19.5	20.9	19.967
	14	"								
3.586	15	4X4-16.0	T	19.5	20.9	19.5	20.9	19.5	20.9	20.900
3.416	16	↓	↓	20.5	22.0	18.5	19.8	16.5	17.5	19.767
	17									101.834
	18									
1.314	19	Spacers	T	18	19.2	18	19.2	19	19.2	19.200
	20								OUT	Spacers

	Kindling	Pretest Fuel	Test Load
% Moisture - Dry Basis:	8.400 %	20.9202 %	20.3668 %
% Moisture - Wet Basis:	7.749 %	17.301 %	16.921 %

13.306   4X4 7.328

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

1 10.952
2 13.668
3 10.632

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

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

Unit: Kuma Ashwood
Run#: EPA 2
Date: 2/17/09
Technician: A.T Myren
WST2-form11-Rev 6/90

WOOD DENSITY DETERMINATION
WOODSTOVE TEST DATA SHEET #11

Wood Piece: Nominal Dimensions: 2X4 1.5" x 3.5" x 3.5"

Depth (D): 3.875 cm

Width (W): 8.860 cm

Length (L): 8.790 cm
8.885 cm
8.520 cm
8.555 cm

Length $\bar{X}$ = 8.6875 cm

Volume: 298.264 cm^3
(D X W X L)

MOISTURE: Room Temperature: 64.3 °F Correction Factor: +0.5

Uncorrected Meter Readings Corrected for temperature: Yes ✓ No___

NOTE: Record moisture meter readings to the nearest 0.5%

	Uncor	Cor
Top:	17.5	18.6 %
Bottom:	18.0	19.2 %
Side:	16.5	17.5 %
$\bar{X}$:		18.433 %

Avg % Moisture (Dry) 18.433 %

Aug % Moisture (Wet) 15.564 %

Scale: Leveled In ✓ Out___

Zeroed: In ✓ Out___

Wet Weight: 150.8 g Dry Weight: 127.2 g

% Moisture Dried Basis: 15.65 %
[1 - (Dry Wt ÷ Wet Wt)] X 100

	Date	Time	Temp
Into Dryer	2/17/09	12:05	190 °F
Out of Dryer	3/2/09	0915	192 °F

(Minimum Time in Dryer: 24 hrs.) Minimum Dryer Temp 100°C (212°F)

Density = 127.2 g (dry wt) ÷ 298.264 cm^3 (volume) = 0.4265 g/cm^3

Pellet Fuel Moisture Content Determination

Tare Beaker Wt. ____ g

Wet Wt: ____ g - ____ g = ____ g
Gross Wet Wt. Tare Beaker Wt. Net Wet Wt.

Dry Wt: ____ g - ____ g = ____ g
Gross Dry Wt. Tare Beaker Wt. Net Dry Wt.

% Moisture Dried Basis: ____ %
[1 - (Net Dry Wt ÷ Net Wet Wt.)] X 100

Pre Burn Start WT.
610 lbs. lp 773.1 lbs.
Test Start wt. Range
767.1 - 766.5 lbs.

PRE BURN DATA
RECORD SHEET #13
WST2-Form16

BARO. PRESSURE
28.22 "Hg

Unit: Kuma Ashwood
Run: EPA2
Page: 1 of 1

Date: 2-17-09
Technician(s): ATM JRP PDG

Hot Box On ✓

Minute	Time	Scale Weight	Burn Rate	T/C#-3 Stack	4 Stove Top	5 Left Side	6 Back	7 Right Side	8 Bottom	9 Firebox	10 2nd Burn	17	11 Room Temp	Static	Comments
0	1225	773.1	0	449	906	594	451	588	412	911	1394		81	-.064	Primary Air Set at Thr. 2.736"
5	30	772.3	.8	436	898	587	440	578	411	935	1353	1220	80	-.062	Secondary Air Set at fixed
10	35	771.4	.9	431	869	584	430	570	409	950	1330	1273	81	-.062	Fan: On Low
15	40	770.6	.8	426	899	585	424	566	405	961	1257	1296	81	-.062	Tunnel on at: 1301
20	45	769.7	.9	428	914	589	420	562	400	966	1268	1144	81	-.062	Buckets Iced ✓
25	50	769.0	.7	421	918	594	415	564	396	989	1332	1164	81	-.060	Analyzers Spanned ✓
30	55	768.4	.6	409	905	603	414	565	391	1005	1379	1186	81	-.058	Pumps turned on at:
35	1300	768.0	.4	383	873	609	416	573	386	1013	1458	1318	82	-.056	571.8 ΔT ΔT
40	05	767.8	.2	343	785	604	428	575	384	1012	1340	1211	83	-.050	555.2 - -16.6
45	10	767.6	.2	322	724	595	454	575	382	1002	1244	1163	83	-.047	Check WB/DB: 546.0 - -9.2
50	15	767.4	.2	306	674	585	454	571	381	990	1145	1092	83	-.044	533.0 - 13.0
55	20	767.3	.1	292	626	572	456	562	380	960	1065	1045	83	-.043	519.2 - -13.8
		—												—	Probe In Tunnel
60	1325	767.2	.1	279	583	557	451	549	361	943	1010	971	83	-.042	Tunnel ΔP 504.2 -15.0
65	30	767.1	.1	275	562	546	446	542	361	921	990	948	82	-.040	495.8 -9.4
70	35	767.0	.1	269	538	537	440	532	361	899	966	929	82	-.038	485.6 -10.
75	40	766.9	.1	243	516	526	432	522	361	883	947	916	82	-.036	✓ 475.8 9.8
80															
85															
90															

Start 475 (480)

Myren Consulting Inc Data Sheet P1 of 4 Unit Kuma Ashwood Date 2/17/09 Run EPA 2
Test En (766.9 ΔT 4758 Barometric Pressure 28.21 "hg Gas Flows @ 1.5" Technician(s) ATM JR PDG

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
0	1340	780.2	13.3	0	.1314	7.81		12.26	.166	1.66	4.7	Fan off				263	-.038
05	45	779.4	12.5	.8	.1443	11.00		9.59	.062	.62	17.7	L				414	-.064
10	50	778.7	11.8	.7	.1526	13.05		7.27	.116	1.16	11.3	L-W				377	-.055
15	55	778.0	11.1	.7	.1621	15.40		5.07	.086	.86	17.9	wispy				370	-.056
20	1400	777.2	10.3	.8	.1683	16.93		3.48	.108	1.08	15.7	L-W				383	-.057
25	05	776.4	9.5	.8	.1728	18.04		2.13	.145	1.45	12.4	L				397	-.058
30	10	775.7	8.8	.7	.1735	18.22		1.76	.185	1.85	9.8	L-W Fan on				402	-.059
35	15	774.9	8.0	.8	.1710	17.60		2.65	.131	1.31	13.4	L 3's thru 5's again				399	-.058
40	20	774.2	7.3	.7	.1725	17.97		2.12	.162	1.62	11.1	L-W				401	-.058
45	25	773.6	6.7	.6	.1672	16.66		3.58	.132	1.32	12.62	wispy				390	-.056
50	30	773.0	6.1	.6	.1652	16.17		4.15	.116	1.16	13.9	"				382	-.055
55	35	772.4	5.5	.6	.1627	15.55		4.83	.104	1.04	13.0	wisps				371	-.054
Tot																4549	.668

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2^{nd} burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 #19	Tube 3 #20
0	1340	518	526	432	522	381	863	947	82	104	215	34	83	62	916			
05	45	557	517	414	506	382	729	1370	82	133	223	35	86	39	1142			
10	50	660	525	393	515	381	736	1364	82	116	237	35	88	38	1212			
15	55	687	523	374	515	380	757	1396	82	113	237	35	88	38	1277			
20	1401	734	526	360	517	378	786	1413	82	115	234	35	88	38	1325			
25	05	780	534	351	521	373	830	1416	82	115	232	36	88	38	1366			
30	10	816	545	343	527	369	871	1417	83	116	230	36	88	38	1357			
35	15	824	555	336	532	363	926	1389	83	116	229	37	88	38	1331			
40	20	838	563	331	534	358	966	1394	84	116	227	38	88	36	1344			
45	25	825	572	330	538	353	998	1369	84	115	224	38	88	38	1331			
50	30	805	575	334	540	349	1007	1370	84	115	226	38	88	38	1324			
55	35	781	575	341	542	347	1004	1341	84	114	226	38	88	38	1337			
Tot		8825	6536	4339	6311	4414	10473	16186	994									

Myren Consulting Inc Data Sheet P2 of 4 Unit Kuma Ashwood Date 2 / 14 / 04 Run EPA 2
Test End 7661.9 ΔT 4751.8 Barometric Pressure 28.27 hg Gas Flows @ 1.5" Technician(s) ATM JRP DG

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
60	1440	771.9	5.0	.5	.1624	15.47		4.94	.1096	.98	15.8	wisps 5 full				363	-.052
65	45	771.4	4.5	.5	.1585	14.51		6.02	.1093	.93	19.9	clear				354	-.051
70	50	770.9	4.0	.5	.1600	14.88		5.67	.1070	.70	21.3	wispy				349	-.051
75	55	770.5	3.6	.4	.1622	15.43		5.10	.1074	.74	20.8	clear				348	-.051
80	1500	770.1	3.2	.4	.1576	14.34		6.30	.1053	.53	27.1	"				341	-.050
85	05	769.8	2.9	.3	.1506	12.56		7.96	.1077	.77	16.3	W-L lustmu	4 issassy			326	-.048
90	10	769.5	2.6	.3	.1465	10.31		10.03	.1113	1.13	9.1	"				306	-.045
95	15	769.3	2.4	.2	.1405	10.06		10.26	.1116	1.16	8.7	light				294	-.044
100	20	769.1	2.2	.2	.1408	10.14		10.15	.1122	1.22	8.3	L-W				287	-.042
105	25	769.0	2.1	.1	.1349	8.68		11.62	.1120	1.20	7.2	clear				278	-.041
110	30	768.9	2.0	.1	.1344	8.56		11.82	.104	1.04	8.2	"		DXD		270	-.040
115	35	768.7	1.8	.2	.1341	8.48		11.88	.108	1.08	7.9	" 2 has bkn and is straight down				265	-.039
Tot																3781	.554

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2nd burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 #19	Tube 3 #20
60	1440	760	577	350	544	345	1000	1339	84	113	229	39	88	38	1329			
65	45	741	578	359	547	342	991	1270	84	112	225	39	86	39	1377			
70	50	726	577	369	549	341	993	1293	84	111	222	40	88	39	1386			
- 75	55	722	579	379	551	339	1007	1323	84	111	220	40	88	39	1407			
80	1500	712	581	387	554	336	979	1346	84	110	216	40	86	39	1435			
85	05	690	580	401	556	337	951	1199	84	108	216	39	88	39	1416			
90	10	651	571	425	554	335	920	1146	84	107	220	39	87	39	1249			
95	15	618	561	443	550	334	909	1143	83	105	221	39	87	39	1240			
100	20	595	552	453	545	333	869	1126	83	104	221	39	86	36	1216			
105	25	572	542	460	538	332	872	1086	83	103	220	38	86	38	1206			
110	30	552	533	466	532	331	865	1044	83	103	216	38	86	39	1170			
115	35	533	525	464	525	330	856	1011	83	101	217	38	86	39	1114			
Tot		7872	6756	4956	6545	4037	11232	14336	1003									

Myren Consulting Inc Data Sheet P3 of 4 Unit Kuma Ashwood Date 2 / 17 / 09 Run FPA2

Test Er)t. 766.9 ΔT 475.8 Barometric Pressure 28.22 "hg Gas Flows @ 1.5" Technician(s) ATM JRF PDG

Time E/T min	Time	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
120	1540	768.6	1.7	.1	.342	8.51		11.84	.110	1.10	7.7	clear				260	-.037
125	45	768.5	1.6	.1	.332	8.26		12.04	.121	1.21	6.8	"				255	-.037
130	50	768.4	1.5	.1	.330	8.21		12.04	.130	1.30	6.3	"				251	-.036
135	55	768.3	1.4	.1	.327	8.14		12.07	.138	1.38	5.9	"				248	-.036
140	1600	768.2	1.3	.1	.321	7.99		12.21	.140	1.40	5.7					246	-.036
145	05	768.1	1.2	.1	.327	8.14		12.04	.144	1.44	5.6					244	-.035
150	10	768.0	1.1	.1	.326	8.11		12.04	.150	1.50	5.4	"				241	-.035
155	15	767.9	1.0	.1	.325	8.09		12.00	.163	1.63	5.0					239	-.034
160	20	767.8	.9	.1	.302	7.52		12.57	.162	1.62	4.6					236	-.034
165	25	767.7	.8	.1	.291	7.25		12.83	.165	1.65	4.4	"				232	-.034
170	30	767.6	.7	.1	.283	7.05		13.04	.162	1.62	4.4					232	-.034
175	35	767.5	.6	.1	.281	7.00		13.09	.163	1.63	4.3	"				229	-.034
Tot																2913	.422

Time E/t	Time	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2nd burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 #19	Tube 3 #20
120	1540	517	519	461	519	329	846	973	82	101	219	39	65	39	1070			
125	45	503	513	457	512	326	835	948	82	100	222	38	65	39	1045			
130	50	492	507	455	506	327	823	935	82	100	225	38	65	39	1036			
135	55	484	503	454	501	327	816	931	82	99	225	38	65	39	1016			
140	1600	474	498	452	494	325	810	928	82	99	223	38	64	39	1012			
145	05	467	494	450	489	324	806	921	82	98	221	38	64	39	999			
150	10	462	491	450	485	325	804	914	81	97	220	38	64	39	990		ΔT	ΔΔT
155	15	456	488	450	480	324	803	905	81	97	220	38	64	39	954		439.6	-36.2
160	20	450	485	450	475	324	797	891	80	97	220	38	64	39	947			
165	25	442	480	449	471	323	791	891	80	96	219	37	63	38	957			
170	30	438	477	451	467	323	784	869	80	96	220	38	63	38	930			
175	35	431	474	446	462	322	773	859	80	95	219	38	63	38	903		427.0	-48.8
Tot		5616	5929	5425	5861	3901	9688	10985	974									

Myren Consulting Inc Data Sheet P4 of 4 Unit Kuma Ashwood Date 2 / 17 / 09 Run EP1
Test En 766.9 ΔT 47518 Barometric Pressure 28.23 g Gas Flows @ 1.5" Technician(s) ✓ATM ✓JRP DG

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal		Opacity	Notes	Stack Temp #3	Stack Static Press
180	1640	767.5	.6	0	.1280	6.97		13.15	.156	1.56	4.5		Clear		227	-.033
185	45	767.4	.5	.1	.1292	7.27		12.84	.158	1.58	4.6		"		224	-.032
190	50	767.3	.4	.1	.1296	7.37		12.78	.156	1.56	4.7				224	-.032
195	55	767.2	.3	.1	.1297	7.39		12.73	.156	1.56	4.7				223	-.031
200	1700	767.1	.2	.1	.1292	7.27		12.89	.149	1.49	4.9				222	-.031
205	05	767.0	.1	.1	.1273	6.80		13.35	.150	1.50	4.5				221	-.030
210	10	766.9	0	.1	.1253	6.31		13.77	.165	1.65	3.8				220	-.030
215															1561	.219
220														Total	12804	.863
225														AVG ÷ 43	298	.043
230																
235																
Total																

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2nd burn #10	Amb. #11	Tnl #12	C Gas #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	center screen 17	ΔT 4
180	1640	426	471	441	458	322	763	856	60	95	219	38	63	38	912	
185	45	421	468	436	453	322	753	849	61	95	220	38	63	38	692	42010 -55
190	50	418	466	434	450	322	749	847	60	95	222	38	63	39	696	
195	55	415	463	436	448	321	744	846	60	95	223	38	63	39	902	41616 -5
200	1700	412	460	437	446	321	741	855	60	95	223	38	63	38	912	
205	05	410	457	440	445	320	731	829	60	95	223	38	63	39	862	
210	10	407	453	436	443	319	721	817	60	95	223	38	63	39	846	41414 -6
215		2909	3238	3062	3143	2247	5202	5899	561							41210
220		25222	22459	17782	21860	14599	36597	17406	3532	Total			Delta	T		-6
225		587	522	414	508	340	851	1102	82	Avg	÷ 43		Start	475.8	—	
230													Stop	412.0	—	
235													ΔΔT	-63.8	—	
Total																

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-1

Colville
Site: Myren Consulting, [redacted], WA Date: 2/17/09 Analyte: CO_2

Source: Kuma Ashwood Run #: EPA 2

Zero Cyl #: TC 30AM154 Conc. 00.0 % CO_2 Cyl Press: 1540 psi

Certified by: Oxarc Date: 11/12/07

Span Cyl #: AS90457 Conc. 12.5 % CO_2 Cyl Press: 1475 psi

Certified by: Matheson Tri Gas Date: 2/2/2009

Analyzer: Make: Horiba Model: PIR-2000 SN: 607024

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

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter: ____

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

Pre Run Audit: By: A.T. Myren Time: 1255 Temp: 80 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.001	.07925	+0.07925	+0.32
Span	50.0	.500	12.5	49.75	.499	12.3858	-0.1142	-0.91

Comments:

Post Run Audit: By: A.T. Myren Time: 1755 Temp: 84 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.001	.07925	+0.07925	+0.32
Span	50.0	.500	12.5	49.75	.501	12.4352	-0.06482	-0.52

Comments:

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

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

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

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-3

Site: Myren Consulting, ~~Woodinville~~ Colville, WA Date: 2/17/09 Analyte: CO

Source: Kuma Ashwood Run #: EPA 2

Zero Cyl #: TC3AAM 154 Conc. 00.0 % CO Cyl Press: 1540 psi

Certified by: Oxarc Date: 11/12/07

Span Cyl #: AS90457 Conc. 2.00 % CO Cyl Press: 1475 psi

Certified by: Matheson Tri Gas Date: 2/2/09

Analyzer: Make: HORIBA Model: MEXA 311GE SN: 6E-30075

Range: 0 - 10.0% CO Analyzer Output: 0 - 1.0 V

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter: ____

EPA Span Value = 5.0% CO
EPA Control Limits = ±2.5% of 5.0% CO = ± 0.125% CO

Pre Run Audit: By: A.T. Myren Time: 1255 Temp: 80 °F

Audit Results

Point #	Expected Response Meter	Expected Response DVM	Expected Response %	Actual Response Meter	Actual Response DVM	Actual Response %	± Conc. Difference	Δ %
Zero	00.0	00.0	00.0	00.0	.001	.00563	+0.00563	+0.06
Span	2.00	.200	2.00	1.99	.199	1.9959	-0.00411	-0.21

Comments:

Post Run Audit: By: A.T. Myren Time: 1755 Temp.: 84 °F

Audit Results

Point #	Expected Response Meter	Expected Response DVM	Expected Response %	Actual Response Meter	Actual Response DVM	Actual Response %	± Conc. Difference	Δ %
Zero	00.0	00.0	00.0	00.0	.001	.00563	+0.0563	+0.06
Span	2.00	.200	2.00	1.98	.198	1.9858	-0.01416	-0.71
				1.24	.124	1.242	-0.0180	-1.43

Comments:

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

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

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

Unit: Kuma Ashwood
Run: FP 2
Date: 2/17/09
Technicians: ATM JRP PDG
WSTS-Form3-Rev11/89

QUALITY CHECKS
WOODSTOVE DATA SHEET #16

Ambient = Tr: ______ °F T/C#30: ______ °F

Thermocouple Check (at ambient): T/C#1: — °F; T/C#2: 70.8 °F;

T/C #3: 71.1 °F;	T/C #4: 70.4 °F;	T/C #5: 71.3 °F;
T/C #6: 69.2 °F;	T/C #7: 70.2 °F;	T/C #8: 73.4 °F;
T/C #9: 71.6 °F;	T/C #10: 77.8 °F;	T/C #11: 64.3 °F;
T/C #12: 69.7 °F;	T/C #13: 67.6 °F;	T/C #14: 61.9 °F;
T/C #15: 67.0 °F;	T/C #16: 53.3 °F;	T/C #17: 76.6 °F;
T/C #18: — °F;	T/C #19: ______ °F;	T/C #20: ______ °F;
T/C #21: ______ °F;	T/C #22: ______ °F;	T/C #23: ______ °F;
T/C #24: ______ °F;	T/C #25: ______ °F;	T/C #26: ______ °F;

Comments: ______

Thermocouple Readout: Pretest Zero/Span Check and Calibration:

Zero (0°F): -0.5 °F	Adj to: — °F	Post Test Check Zero (0°F): 0.2 °F	% Difference +0.04
Span (2000°F): 2000.7 °F	Adj to: — °F	Span (2000°F): 2002.7 °F	+0.11

(Allowable % Difference = 1.5%. Use formulas on Woodstove Data Sheet #15 to calculate % Difference) In Degrees Absolute.

Thermocouple Readout Pretest Linearity Check

0°F = -0.2 °F;	200°F = 201.6 °F;	400°F = 399.0 °F;
600°F = 601.3 °F;	800°F = 801.6 °F;	1000°F = 1000.8 °F;
1200°F = 1198.6 °F;	1400°F = 1399.6 °F;	1600°F = 1600.2 °F
1800°F = 1800.5 °F;	2000°F = 2000.7 °F	

Combustion Gas (CO_2, O_2, CO) Train Leak Check: Pre ✓ OK PDG Post ✓ PDG OK

Draft (Static) Guage Zero Check: Pre ✓ JRP Post ✓ PDG

Scale Check Pre (Wt, #'s): 768.8 - 763.8 lbs = 5.0 lbs / 5.0 lbs = Ok ATM

Post (Wt, #'s): 771.6 - 766.6 lbs = 5.0 lbs / 5.0 lbs = OK PDG

Stack cleaned prior to the run: Yes ____ No ✓

Tunnel cleaned prior to the run: Yes ____ No ✓

HI

DILUTION TUNNEL CALCULATIONS

1\25\09, Md=28.56, Bws=4%

6" Tunnel

MYREN CONSULTING CERTIFICATION TEST DATA

File Name:	EPA 1
Manufacturer:	KUMA
Model Number:	ASHWOOD
Lab Name:	MYREN
Test Date:	2\16\09
Run Number:	EPA 1
Meter Box Y Factor:	1.0177
Barometric pressure (in):	28.153
Gas meter temp (ave):	**86**
delta H(avg):	**0.900**
Gas meter initial reading:	977.0000
Gas meter final reading:	1045.5140
Front catch (acetone) mg:	7.8
first filter catch (mg):	18.2
second filter catch (mg):	-2.3
Tunnel Flow (Qsd) (dscfm)	**141.996**
Emission Rate(g/hr):	**3.178**
Emission Rate(M5H) :	**4.752**
Avg. of Delta P Sq. Roots:	**0.2143**
Vs (Avg.)(ft/min):	**896.795**
Tunnel Avg. Temperature (F):	**131.000**
Test time(min):	128
Fuel Load(lb. wet):	13.210
Wood moisture(%wet):	16.976
Burn rate(dry kg/hr):	**2.332**
Sample Volume (dscf)	**63.536**
Avg. Tunnel Static (-inch H2O):	**0.1916**
Room Blank Catch (mg/dscf):	0
Emission Factor (g/kg):	**1.3628**
Pitot Correction Factor:	0.9611
front filter number	706
back filter number	705
Beaker Number:	21
PRELIMINARY RESULTS	
FINAL RESULTS:	AUDITED
DATA SUMMARY	
MODEL:	ASHWOOD
RUN:	EPA 1
DATE:	2\16\09
DBR:	2.332
EMISSION RATE (g/hr)(M5H)	4.7518
EMISSION FACTOR (g/kg):	1.3628
AVG. % PROPORTIONALITY :	95.983

RUN TIME (min)	PITOT DELTAP (- INCH H20)	TNL TEMP (°F)	GAS METER RDG (ft3)	GAS METER TEMP (°F)	GAS METER DELTA H (in.H2O)	TUNNEL VELOCITY (ft/min)	PROP RATE (%)	dDGM vol std (ft3)	Tunnel Static (- Inch H2O)	SQUARE ROOT DELTA P	DRY GAS METER RDG (m3)
0	0.046	126	977.0000	72	0.900	930.03			0.195	0.2145	
10	0.046	145	982.3220	75	0.900	944.98	100.7	5.039	0.190	0.2145	
20	0.045	152	987.6200	78	0.900	940.05	100.8	4.989	0.193	0.2121	
30	0.046	151	992.9500	82	0.900	949.66	98.8	4.982	0.194	0.2145	
40	0.047	143	998.2580	85	0.900	953.62	95.6	4.934	0.191	0.2168	
50	0.047	137	1003.5600	87	0.900	948.87	94.3	4.910	0.193	0.2168	
60	0.048	133	1008.8900	89	0.900	955.69	92.8	4.918	0.193	0.2191	
70	0.045	133	1014.2480	90	0.900	925.34	96.0	4.935	0.190	0.2121	
80	0.045	129	1019.6180	91	0.900	922.22	95.6	4.937	0.192	0.2121	
90	0.045	124	1025.0030	91	0.900	918.30	95.4	4.951	0.193	0.2121	
100	0.045	121	1030.3950	92	0.900	915.93	95.0	4.948	0.191	0.2121	
110	0.046	117	1035.7840	92	0.900	922.86	93.6	4.946	0.194	0.2145	
120	0.045	113	1041.1070	92	0.900	909.60	93.1	4.885	0.188	0.2121	
128	0.045	110	1045.5140	92	0.900	907.21	96.1	4.045	0.186	0.2121	
			0.0000		0.900	0.00	0.0	0.000		0.0000	
150			0.0000		0.900	0.00	0.0	0.000		0.0000	
160			0.0000		0.900	0.00	0.0	0.000		0.0000	
170			0.0000		0.900	0.00	0.0	0.000		0.0000	
180			0.0000		0.900	0.00	0.0	0.000		0.0000	
190			0.0000		0.900	0.00	0.0	0.000		0.0000	
200			0.0000		0.900	0.00	0.0	0.000		0.0000	
210			0.0000		0.900	0.00	0.0	0.000		0.0000	
220			0.0000		0.900	0.00	0.0	0.000		0.0000	
230			0.0000		0.900	0.00	0.0	0.000		0.0000	
240			0.0000		0.900	0.00	0.0	0.000		0.0000	
250			0.0000		0.900	0.00	0.0	0.000		0.0000	
260			0.0000		0.900	0.00	0.0	0.000		0.0000	
270			0.0000		0.900	0.00	0.0	0.000		0.0000	
280			0.0000		0.900	0.00	0.0	0.000		0.0000	
290			0.0000		0.900	0.00	0.0	0.000		0.0000	
300			0.0000			0.00	0.0	0.000		0.0000	
310			0.0000			0.00	0.0	0.000		0.0000	
320			0.0000			0.00	0.0	0.000		0.0000	
330			0.0000			0.00	0.0	0.000		0.0000	
340			0.0000			0.00	0.0	0.000		0.0000	
350			0.0000			0.00	0.0	0.000		0.0000	
360			0.0000			0.00	0.0	0.000		0.0000	
370			0.0000			0.00	0.0	0.000		0.0000	
380			0.0000			0.00	0.0	0.000		0.0000	

METHOD 5G-1 (EPA) PARTICULATE SAMPLING DATA **Rev. 2/09**

DATE: 2/16/09 **PAGE** 1 **OF** 1 **UNIT:** Kuma Ashwood **RUN:** EPA 1

METER BOX: 45G-P **METER Y:** 1.0177 **FILTER #'S: (F)** 706 **(R)** 705

.890/ .892

PRE TEST LEAK CHECK: .002 **CFM @** -16.1 **IN HG** **FILTER SIZE:** 110 **mm**

.578/.579

POST TEST LEAK CHECK: .001 **CFM @** -16.1 **IN HG** **PROBE LENGTH** 21.5 **IN**

Pitot Pg	TIME CLOCK	TIME ELAPSED	METER READING (FT^3)	PITOT ΔP	TUNNEL TEMP (°F)	METER TEMP (°F)	DRY GAS METER Δh	VAC (in Hg)
-.195	1655	00	977.000	.046	126	72	0.90	Ø
-.190	1705	10	982.322	.046	145	75	.90	0
-.193	15	20	987.620	.045	152	78	.90	0
-.194	25	30	992.950	.046	151	82	.90	0
-.191	35	40	998.258	.047	143	85	.90	0
-.193	45	50	1003.560	.047	137	87	.90	0
-.[illegible]3	55	60	1008.890	.048	133	89	.90	0
-.190	1805	70	1014.248	.045	133	90	.90	0
-.192	15	80	1019.618	.045	129	91	.90	0
-.193	25	90	1025.003	.045	124	91	.90	0
-.191	35	100	1030.395	.045	121	92	.90	0
-.194	45	110	1035.784	.046	117	92	.90	0
-.188	55	120	1041.107	.045	113	92	.90	0
-.186	1903	~~40~~ 128	1045.514	.045	110	92	.90	0
		50						
		60						
		70						
		80						
		90						

Pre Test Filter Check Weigh
F .6944
R .6835

End of Test Weight
F .7139 R .6818
.6948 .6837
.0191 0

BP: 00 28.16
60 28.15
120 28.15

X= 28.153"Hg

MYREN CONSULTING, INC.
Dilution Tunnel Traverse Data with 8 Traverse Points

Unit: Kuma Ashwood
Run #: EPA 1
Date: 2/ 16 /09
Technicians: ATM KRP PDG
Rev 4/2/08

Point	Location	Δp	$\sqrt{\Delta p_{trav}}$	Δp	$\sqrt{\Delta p_{cent}}$	#12 T_{trav}	#12 T_{cent}	Pg
W-1	0.5"	.043	.2074			155		
2	1.5	.048	.2191			156		
Center	Center			.051	.2258		156	-.214
3	4.5	.053	.2302			154		
4	5.5	.042	.2049			152		
S-1	0.5	.044	.2098			150		
2	1.5	.050	.2236			150		
Center	Center			.052	.2280		150	-.214
3	4.5	.052	.2280			149		
4	5.5	.050	.2236			148		
	Totals		1.7466		.4538	1214	306	-.428
	Average		.2183		.2269	151.75	153	-.214
	°R = (°F + 460)					611.75	613	

Ps = BP + (-Pg/13.6) = 28.16 + (.214 /13.6) = 28.144

LEAK CHECKS:
Pre Test: Pg Leg: ✓ PDG Velocity Head Leg: ✓ PDG
Post Test: Pg Leg: Ok ATM Velocity Head Leg: Ok ATM

DILUTION TUNNEL GAS VELOCITY & VOLUMETRIC FLOW RATE CALCULATIONS Rev 4/19/08

UNIT: Kuma Ashwood DATE: 2/16/09 RUN #: EPA 1 TECHNICIAN(S): ATM JRP

Average Gas Velocity in the Dilution Tunnel Vstrav (EPA M2 EQN 2-9, ASTM E 2515-07 EQN 7)

(9) Vstrav = (85.49)(0.99 cp){2} (.2183{2} x $\sqrt{\Delta P}$ "H_2O) $\sqrt{\dfrac{611.75\{0\}\ \text{Ts °A}}{(28.144\{2\}\ \text{Ps "Hg})\ (28.56\ \text{lb./ lb. mole})}}$ = 16.1183{2} fps

(9A) Vs = (16.1183{2} fps)(60) = 967.098{2} fpm

Gas Velocity in the Center of the Dilution Tunnel - Vscent (EPA M2 EQN 2-9, ASTM E 2515-07 EQN 7)

(9) Vscent = (85.49)(0.99 cp){2} (.2269{2} x $\sqrt{\Delta P}$ "H_2O) $\sqrt{\dfrac{613\{0\}\ \text{Ts °A}}{(28.144\{2\}\ \text{Ps "Hg})\ (28.56\ \text{lb./ lb. mole})}}$ = 16.7704{2} fps

(9A) Vs = (16.7704{2} fps)(60) = 1006.224{2} fpm

EPA M5G1 Section 4.2.2, ASTM E 2515-07 EQN 1 Adjustment Factor for Center of Tunnel Pitot Tube Location

Fp = Vstrav/ Vscent = 16.1183 ÷ 16.7704 = 0.9611

Average Stack Gas Dry Volumetric Flow Rate - Qsd (EPA M2 EQN 2-10, ASTM E 2515-07 EQN 3)

(10) Qsd = 3600(1 - 0.04 Bws)(16.1183{2} fps)(.1963{3} ft^2)[(528 °A)(28.144{2} Ps "Hg)/(611.75{0} T_s °A)(29.92" Hg) = 8877.638{1} dscfhr (or dscfh)

(10A) 8877.638{1} dscfhr ÷ 60 = 147.961{1} dscfmin (or dscfm)

Note: Number in { } under blank lines denotes number of decimals to be used. If a blank calls for an answer already calculated, use the number of decimals previously specified for that answer.

WST5-Form9,Pg2,Rev1/90

WOODSTOVE DATA SHEET #4-1: INITIAL FILTER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date 1-20-09 Time 1149 By PDG Front Half X Back Half X

Manufacturer: Pall P/N 60115 Size: 110 Lot.No.: 70726 Grade: A/E Glass

Filter #	First Wt	2009 Date	Time	By	Second Wt	Date	Time	By	Third Wt	2009 Date	Time	By
700	.6873	1-22	1331	GRP	.6877	1-23	1417	PDG				
701	.6871		1330	GRP	.6878		1419	PDG	.6877	1.26	1421	GRP
702	.6816		1329	GRP	.6825		1420	PDG	.6824	1.26	1920	GRP
703	.6761		1328	GRP	.6762		1421	PDG				
704	.6727		1327	GRP	.6732		1422	PDG				
705	.6833		1326	GRP	.6837		1423	PDG				
706	.6946		1325	GRP	.6948		1424	PDG				
707	.6773		1324	GRP	.6777		1425	PDG				
708	.6701		1323	GRP	.6702		1426	PDG				
709	.6799		1322	GRP	.6809		1427	PDG	.6806	1.26	1419	GRP
710	.6587		1321	GRP	.6590		1428	PDG				
711	.6654		1320	GRP	.6656		1429	PDG				
712	.6688		1319	GRP	.6892		1430	PDG				
713	.6864		1318	GRP	.6866		1431	PDG				
714	.6651		1318	GRP	.6655		1432	PDG				
715	.6741		1317	GRP	.6744		1433	PDG				
716	.6592		1316	GRP	.6590		1434	PDG				
717	.6531		1315	GRP	.6536		1435	PDG				
718	.6621		1314	GRP	.6623		1436	PDG				
719	.6769		1313	GRP	.6769		1437	PDG				
720	.6627		1312	GRP	.6628		1438	PDG				
721	.6567		1311	GRP	.6569		1439	PDG				
722	.6539		1310	GRP	.65340		1440	PDG				
723	.6552		1309	GRP	.6552		1441	PDG				
724	.6655		1308	GRP	.6656		1442	PDG				

Checked by [illegible] Date: 1/27/09 Time 1632

QA REWEIGH

Filter #	WT	Date	Time	By
703	.6761	1/27/09	1639	ATM
708	.6705		1640	ATM
715	.6749		1642	ATM

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
57	72	38	1-22-09	1138	ATM
58	75	23	1.23.09	1150	PDG
56	74	25	1.26-09	1359	GRP
58	72	31	1/27/09	1530	PDG

Post	1-22	1.23	1.26
0.0000	0.0000	0.0000	0.0000
100.0000	99.9994	99.9993	99.9993

WST5-Form9, Pg3, Rev6/90

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date: 01.26.09 Time: 15:38 By: JRP

Beaker #	First Wt	2009 Date	Time	By	Second Wt	2009 Date	Time	By	Third Wt	Date	Time	By
20	73.3181	1/27	1532	PDG	73.3176	1.29	1459	JRP		1/30		
21	71.0021		1534	PDG	71.0018		1458	JRP	←			
22	71.8343		1535	PDG	71.8338		1457	JRP				
23	70.7390		1536	PDG	70.7389		1455	JRP				
27	72.3310		1538	PDG	72.3307		1500	JRP				
31	69.6672		1539	PDG	69.6669		1501	JRP				
32	53.6002		1541	PDG	53.5993		1502	JRP	53.5998		1305	PDG
37	53.7267		1542	PDG	53.7262		1504	JRP				
38	53.2525		1544	PDG	53.2516		1505	JRP	53.2520		1308	PDG
39	53.1509		1545	PDG	53.1493		1506	JRP	53.1496		1311	PDG
40	53.4626		1547	PDG	53.4622		1507	JRP				
41	52.8371		1549	PDG	52.8367		1508	JRP				
42	53.8699		1550	PDG	53.8692		1509	JRP	53.8696		1302	PDG

Checked By: ATM Date: 2/1/09 Time: 1210

QA REWEIGH

Beaker #	WT	Date	Time	By
20	73.3181	2/1/09	1215	ATM
31	69.6671		1217	ATM
42	53.8699		1219	ATM

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	2009 Date	Time	By
55	72	37	1/27	1530	PDG
58	77	29	1.29	1436	JRP
60	72	49	1/30	1256	PDG
58	74	37	2/1	1200	ATM

PDA	1/27	1.29	1/30	2/1
	0.0000	0.0000	0.0000	0.0000
	[illegible]	[illegible]	[illegible]	[illegible]

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Blank done 12/9/07

Into Dessicator: Date: 10/12/07 Time: 0801 By: JRP

Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
23	71.8343	10/22/07	1358	JRP	71.8332	11/10/07	1938		71.8330	11-11-07	1748	Jm
24	73.2192		1400	JRP	73.2190	11/10/07	1940		73.2193	11-11-07	1746	Jm
25	72.6516		1401	JRP	72.6512	11/10/07	1944	← Blank				
26	71.7895		1403	JRP	71.7888	11/10/07	1939		71.7886	11-11-07	1747	Jm
27	72.3316		1402	JRP	72.3314	11/10/07	1945					
28	70.5979		1404	JRP	70.5975	11/10/07	1941		70.5977	11-11-07	1745	Jm
39	53.1508		1405	JRP	53.1500	11/10/07	1942					
37	53.7237	11/10/07	1945	MM	53.7238	11/11/07	1743	Jm				

Checked By: ________ Date: ________ Time: ________

QA REWEIGH

Beaker #	WT	Date	Time	By
27	72.3315	11-11	1740	Jm
25	72.6515	11-11	1741	Jm
39	53.1509	11-11	1744	Jm

Post weighing 0.0000g

LSD 0.0000 .0000g

2nd

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
57	68	50	10/22/07	1344	JRP
			11/10		

WST5-Form9 Rev4/90
Unit Kum, Ashwood
Run # EPA D
Date: 2/16/09

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

55 ml

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	2001 Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
21	✓	2-19	1312	GRP	71.0114	2/20	1027	PDG	71.0107	2/21	1530	ATM	71.0105	2/22	1230	Jm
					Fourth											
					71.0098	2/23	1415	PDG	71.0096	2/24	1003	ATM				

FINAL FILTER WEIGHTS

	Filter #	Into Dessic	2009 Date	Time	By	First	2009 Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
F	706	.7138	2/16	1920	ATM	.7133	2-17	1456	GRP	.7130	2/18	1818	ATM				
R	705	.6818	2/16	1920	ATM	.6814	2-17	1454	GRP	.6814	2/18	1819	ATM				

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By

Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	2009 Date	Time	By	WB	DB	%RH
1	2.17	1439	GRP	56	72	35
2	2/18	1800	ATM	55	70	36
3	2/20	1018	PDH	57	74	33
4	2/22	1222	ATM	47	59	37
5	2/23	1406	PDG	58	70	46

SCALE ROOM ENVIRONMENTAL CONDITIONS

6	2/24	0953	ATM	59	76	35
7						
8						
9						

Comments

Acetone
Lot #
041648

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

Tare 72.6512

Blank done 12/19/07

WST5-Form9, Pg1, Rev4/90
Unit Kuma Ashwood
Run # EPA-1
Date: 2/16/09

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	2007 Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
25	✓	12/12	1546	JRP	72.6508	12/13	1342	JRP	72.6511	12/14	1347	JRP				

FINAL FILTER WEIGHTS

Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By
Date	**Filter #**	**Final WT**	**By**

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	2007 Date	Time	By	WB	DB	%RH
1	12/13	1307	JRP	55	73	29
2	12/14	1321	JRP	57	75	31
3						
4						

SCALE ROOM ENVIRONMENTAL CONDITIONS

6					
7					
8					
9					

Comments

WOODSTOVE DATA SHEET 4-4 SCALE QC RECORD SHEET

FROM: 9/27/2007
THROUGH: 12/7/2007

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

Level	Recalibrated	130 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	129.9998	99.9998	10.0000	1.0000	0.1000	0.0199	9/27/07	1402	GRP	55	67	45
✓	Y	129.9995	99.9996	10.0001	1.0000	0.1000	0.0200	9/28/07	1335	GRP	57	69	46
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0200	10/1/07	1505	ATM	58	70	48
✓	N	129.9995	99.9996	10.0000	1.0001	0.1000	0.0199	10/2/07	1611	GRP	56	68	46
✓	N	129.9997	99.9997	9.9999	1.0001	0.1000	0.0199	10/3/07	1122	GRP	56	68	46
✓	N	129.9996	99.9996	10.0000	1.0000	0.0999	0.0199	10/4/07	1225	GRP	55	67	45
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	10/5/07	0750	GRP	51	62	45
✓	N	129.9997	99.9997	9.9999	1.0000	0.1000	0.0199	10/5/07	1513	GRP	56	69	43
✓	Y	129.9996	99.9996	10.0000	1.0001	0.1001	0.0200	10/9/07	1505	ATM	58	71	44
✓	N	129.9996	99.9997	10.0000	1.0001	0.1001	0.0200	10/12/07	1259	ATM	58	70	48
✓	Y	129.9995	99.9996	9.9999	1.0000	0.1000	0.0199	10/22/07	1344	GRP	57	68	50
✓	Y	129.9996	99.9997	9.9999	1.0000	0.1000	0.0199	10/29/07	1338	GRP	53	63	50
✓	N	129.9995	99.9995	10.0000	1.0000	0.1000	0.0200	10/30/07	0933	ATM	56	70	40
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1000	0.0199	10/30/07	1457	GRP	55	70	36
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	10/31/07	1528	GRP	57	75	30
✓	Y	129.9996	99.9996	9.9999	1.0000	0.0999	0.0199	11/2/07	1238	GRP	52	67	33
✓	Y	129.9996	99.9996	10.0000	1.0001	0.1000	0.0199	11/5/07	0730	GRP	57	73	35
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1001	0.0201	11/9/07	1550	ATM	58	70	48
✓	N	129.9996	99.9997	10.0000	1.0000	0.1000	0.0200	11/10/07	1835	ATM	58	71	44
✓	Y	129.9997	99.9997	9.9999	1.0000	0.1000	0.0199	11/11/07	1810	ATM	55	69	39
✓	N	129.9997	99.9996	9.9999	1.0000	0.1000	0.0199	11/12/07	0822	GRP	54	67	41
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	11/13/07	1226	ATM	58	72	41
✓	N	129.9998	99.9997	9.9999	0.9999	0.1000	0.0200	11/14/07	1710	GRP	58	73	39
✓		QC Services Audit 11/14/07											
✓	Y	129.9997	99.9997	10.0000	1.0000	0.1000	0.0200	11/15/07	1350	ATM	59	72	45
✓	N	129.9996	99.9996	9.9999	0.9999	0.1000	0.0200	11/16/07	1600	GRP	58	71	41
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	11/18/07	1758	ATM	60	74	43
✓	Y	129.9997	99.9997	10.0000	1.0001	0.1001	0.0200	11/19/07	1143	ATM	56	70	40
✓	Y	129.9995	99.9996	10.0000	1.0000	0.1000	0.0199	11/20/07	1416	GRP	54	69	35
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	11/27/07	1110	ATM	57	70	44
✓	N	129.9995	99.9996	10.0000	1.0000	0.1000	0.0199	12/3/07	0730	GRP	55	69	40
✓	N	129.9996	99.9996	10.0000	1.0000	0.0999	0.0200	12/6/07	1125	ATM	54	67	44
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/7/07	1348	GRP	55	69	40

ATM

WOODSTOVE DATA SHEET 4-4 SCALE QC RECORD SHEET

FROM: 12/8/07
THROUGH: 2/3/08

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

Level	Recalibrated	130 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/8	1215	ATM	57	73	35
✓	N	129.9996	99.9996	10.0000	1.0000	0.1001	0.0200	12/8	1910	ATM	57	72	38
✓	N	129.9997	99.9996	10.0000	1.0000	0.1000	0.0199	12/9	1935	ATM	55	72	31
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/10	1953	ATM	56	72	34
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/11	1618	GRP	57	76	28
✓	N	129.9997	99.9996	10.0000	1.0000	0.0999	0.0199	12/12	1505	GRP/ATM	56	74	30
✓	N	129.9996	99.9996	9.9999	0.9999	0.1000	0.0199	12/13	1307	GRP	55	73	29
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	12/14	1321	GRP	57	75	31
✓	N	129.9998	99.9998	9.9999	1.0001	0.1000	0.0199	12/15	1602	GRP	57	75	31
✓	Y	129.9996	99.9997	9.9999	1.0000	0.1000	0.0199	12/17	0817	GRP	55	73	29
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/18	0853	GRP	58	75	34
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/19	0812	GRP	55	72	31
✓	Y	129.9995	99.9996	10.0000	1.0001	0.0999	0.0199	12/20	0916	GRP	57	71	41
✓	Y	129.9998	99.9997	10.0000	1.0000	0.1000	0.0199	12/21	1085	ATM	55	70	36
✓	N	129.9997	99.9996	10.0000	1.0000	0.10000	0.0200	12/22	1434	[illegible]	54	66	44
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/23	0915	ATM	57	70	44
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	12/26	1230	ATM	57	70	44
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0200	12/27	1030	ATM	56	72	34
✓	N	129.9998	99.9997	9.9999	1.0000	0.1000	0.0200	1/8/08	1342	GRP	54	68	38
✓	N	129.9997	99.9997	10.0000	1.0001	0.1000	0.0200	1/9/08	0742	GRP	55	70	36
✓	N	129.9998	99.9998	10.0000	1.0000	0.1000	0.0199	1/11/08	1040	ATM	59	73	42
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1000	0.0199	1/16/08	1221	GRP	51	72	18
✓	N	129.9999	99.9998	10.0000	1.0000	0.1000	0.0199	1/17/08	1237	GRP	56	71	37
✓	N	129.9998	99.9998	10.0000	1.0000	0.0999	0.0200	1/18/08	1116	GRP	56	71	37
✓	Y	129.9995	99.9996	9.9999	1.0001	0.1000	0.0199	1/21/08	1426	GRP	56	72	34
✓	N	129.9995	99.9996	10.0000	1.0001	0.1000	0.0199	1/22/08	1513	GRP	56	71	37
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	1/23/08	0805	GRP	54	69	36
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	1/24/08	0758	GRP	54	70	33
✓	N	129.9998	99.9997	10.0000	1.0000	0.1000	0.0199	1/24/08	1450	GRP	56	71	37
✓	N	129.9997	99.9996	10.0000	1.0000	0.1000	0.0200	1/31/08	1505	GRP	55	69	38
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	2/1/08	1029	GRP	54	69	36
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	2/2/08	1620	ATM	58	72	41
✓	N	129.9996	99.9997	10.0000	1.0001	0.1000	0.0200	2/3/08	1710	ATM	57	70	44

WOODSTOVE DATA SHEET 4-4 ANALYTICAL BALANCE QC RECORD SHEET

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

FROM: 12/20/08
THROUGH: 2/17/09

Level	Recalibrated	140 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	12/20/08	1430	ADM	58	72	42
✓	N	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	12/23/08	1057	JRP	60	76	38
✓	N	139.9994	99.9994	9.9999	1.0001	0.1000	0.0200	12/24/08	1019	ATM	59	72	43
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0200	12/26/08	1142	ATM	59	72	45
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0200	12/28/08	1050	ADM	60	75	37
✓	N	139.9994	99.9994	10.0000	.9999	0.1000	0.0199	1/05/09	1157	PDG	58	75	34
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	1/6/09	1845	ATM	60	75	37
✓	N	139.9995	99.9996	9.9999	1.0000	0.1000	0.0199	1/7/09	1530	JRP	58	70	48
✓	N	139.9994	99.9994	9.9999	.9999	0.1000	0.0199	1/8/09	1356	PDG	60	72	49
✓	Yes	139.9993	99.9994	9.9999	1.0000	0.1000	0.0200	1/09/09	1053	PDG	58	72	42
✓	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	1/11/09	1128	JRP	55	72	31
✓	Yes	139.9994	99.9995	9.9999	1.0000	0.1000	0.0199	1/12/09	0845	PDG	59	75	38
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0200	1/13/09	0825	JRP	58	74	37
✓	Yes	139.9993	99.9994	9.9999	0.9999	0.1000	0.0199	1-14-09	1212	PDG	57	72	36
✓	NO	139.9993	99.9993	9.9999	1.0000	0.0999	0.0199	1/14/09	1420	JRP	59	75	37
✓	NO	139.9992	99.9993	10.0000	1.0000	0.0999	0.0199	1-15-09	1128	JRP	58	74	37
✓	Yes	139.9994	99.9995	9.9999	0.9999	0.1000	0.0199	1-20-09	0950	PDG	58	74	37
✓	No	139.9993	99.9994	10.0000	0.9999	0.1000	0.0199	1-20-09	1230	PDG	56	71	37
✓	NO	139.9993	99.9993	9.9999	1.0000	0.0999	0.0199	1-20-09	1613	JRP	57	73	35
✓	No	139.9994	99.9994	9.9999	1.0000	0.1001	0.0200	1/22/09	1138	ATM	57	72	38
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	1/23/09	1150	PDG	58	75	33
✓	YES	139.9992	99.9993	10.0000	1.0000	0.0999	0.0200	1/26/09	1359	JRP	56	76	25
✓	no	139.9994	99.9995	10.0000	1.0000	0.1000	0.0199	1/27/09	1530	PDG	55	72	31
✓	No	139.9993	99.9993	10.0000	1.0001	0.1001	0.0200	1/28/09	1452	ATM	61	75	41
✓	YES	139.9993	99.9994	10.0000	1.0000	0.1000	0.0199	1-29-09	1436	JRP	58	77	29
✓	no	139.9995	99.9995	9.9999	0.9999	0.1000	0.0199	1/30/09	1256	PDG	60	72	49
✓	Yes	139.9993	99.9994	9.9999	1.0000	0.1000	0.0199	2/1/09	1200	ATM	58	74	37
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	2/2/09	1350	JRP	58	77	29
✓	Yes	139.9995	99.9996	9.9999	1.0000	0.1000	0.0199	2/5/09	1118	PDG	59	72	45
✓	NO	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	2/6/09	1150	JRP	57	74	33
✓	No	139.9994	99.9994	10.0000	1.0001	0.1000	0.0200	2/9/09	1015	ATM	49	70	19
✓	NO	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	2/16/09	1551	PDG	61	78	36
✓	NO	139.9993	99.9994	9.9999	1.0000	0.1000	0.0200	2/17/09	1439	JRP	56	72	35

WOODSTOVE DATA SHEET 4-4 ANALYTICAL BALANCE QC RECORD SHEET

FROM: 2/10/09
THROUGH:

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

Level	Recalibrated	140 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
Y	Y	139.9993	99.9995	9.9999	1.0000	0.1000	0.0199	2/10/09	1800	ATM	55	70	36
Y	Y	139.9993	99.9994	9.9999	1.0000	0.1000	0.0199	2-19-09	1248	JRP	56	73	32
Yes	Y	139.9993	99.9994	9.9999	0.9999	0.1000	0.0199	2/20/09	1018	PDG	57	74	33
Yes	Y	139.9993	99.9994	10.0000	1.0000	0.1000	0.0200	2/21/09	1519	ATM	60	77	35
Yes	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	2/22/09	1222	ATM	47	59	37
~~Y~~	~~Yes~~	~~139.9994~~	~~99.9994~~	~~9.9999~~	~~0.9999~~	~~0.1000~~	~~0.0199~~	~~2/23/09~~	~~1406~~	~~PDG~~	~~58~~	~~70~~	~~48~~
Yes	No	139.9994	99.9994	9.9999	1.0000	0.1000	0.0200	2/24/09	0953	ATM	59	76	35
Yes	Yes	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	2/25/09	1123	PDG	60	76	38
Yes	Yes	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	2-26-09	1258	JRP	55	70	36
YES	YES	139.9993	99.9993	9.9999	1.0001	0.1001	0.0200	2/28/09	1330	ATM	57	74	33
Yes	Yes	139.9995	99.9995	9.9999	0.9999	0.1000	0.0199	3/3/09	1431	PDG	59	76	35
~~Yes~~	~~NO~~	~~139.9993~~	~~99.9995~~	~~9.9999~~	~~1.0000~~	~~0.1000~~	~~0.0199~~	~~3/4/09~~	~~1556~~	~~JRP~~	~~56~~	~~70~~	~~40~~
Yes	No	139.9994	99.9994	9.9999	1.0001	0.1001	0.0200	3/5/09	1350	ATM	60	75	40
Yes	No	139.9993	99.9993	9.9999	1.0000	0.1000	0.0200	3/7/09	0850	ATM	57	71	41
Yes	Yes	139.9993	99.9993	10.0000	1.0001	0.1000	0.0200	3/8/09	1323	ATM	55	70	36
Yes	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	3/10/09	1212	PDG	50	75	10

Woodstove Particulate
Catch Processing Sheet
Woodstove Data Sheet #5
EPA M5G-1

Unit : Kuma Ashwood
Run: EPA I
Date: 2/16/09
Technicians: A,T,M
Revised 1/16/98-Data Sheet #5

Filters

Filter # (Front) 706 Beaker # 21 Final Wt. 71.0096 g .0105
Final Wt. .7130 g Ml 55 Tare Wt. 71.0018 g
Tare Wt. .6948 g Desc. Acetone Net Wt. .0078 g
Net Wt. .0182 g

Filter # (Rear) 705 Beaker # ____ Final Wt. ____ g
Final Wt. .6814 g Ml ____ Tare Wt. ____ g
Tare Wt. .6837 g Desc. ____ Net Wt. ____ g
Net Wt. -.0023 g

Acetone Blank Calculation: Blank Date: 12/8/07

Blank Beaker # 25 Final Wt. 72.6511 g
Ml 50 Tare Wt. 72.6512 g
Desc. Acetone Net Wt. -0.0001 g = 0.0000
0.0000 g ÷ 50 ml = 0.00000 g/ml

Blank Residue Value Calculation:

0.00000 g/ml acetone X 55 ml acetone = 0.0000 g
Blank Residue Value

Total Particulate Catch Calculation

Filter: .0182 g
Filter: -.0023 g
Beakers: .0078 g – 0.0000 g = .0078 g
Total Catch Blank Residue Value
Total Catch = .0237 g

Unit Kuma Ashwood
Run # EPA 1
Date 2/16/09
Technician ATM JRP PDG
WST6-Form1,Rev8/96

MISCELLANEOUS TEST DATA
WOODSTOVE DATA SHEET #8

Useable Firebox Dimensions: See QC Section Useable Volume: 2.094 ft^3

Dilution Tunnel Draft (If applicable): Start .000 Stop .000 "H_2O

Test Chamber Air Velocity: Start: 00.0 Stop: 00.0 Avg: 00.0 ft/MIN

Wet Bulb/ Start: WB: 60 °F DB: 76 °F 1.20% Amb Moisture 38 %RH

Dry Bulb Stop: WB: 59 °F DB: 75 °F 1.15% Amb Moisture 37 %RH

$\bar{x}$ = 1.175 % Ambient Moisture $\bar{x}$ = 37.5 % Relative Humidity (RH)

Empty Stove Wt: 440.2 lbs.

Empty Stove Wt with Stack (Inc. Oil Seal) Wet: 763.8 lbs. Dry: 763.8 lbs.

Empty Stove Wt with Stack and Ash Ash: — lbs. Total: — lbs.

Kindling Wt. TOTAL 4.8 lbs. Paper: 0.3 lbs. Wood: 4.5 lbs.

Pre Burn Fuel Wt. 11.430 + 12.606 + 14.212 Total: 38.248 lbs.

Total Kindling and Pre Burn Fuel Wt 43.048 lbs.

Coal Bed Wt-lbs: Range(3.3 - 2.7) 767.1-766.5 lbs. Actual 2.8 766.6 lbs.

Allowable Amount of Charcoal that can be removed:

Coal Bed Wt. Range (3.3 Upper Wt. + 2.7 Lower Wt. /2) X .25 = 0.7 lbs lbs.

Test Fuel Wt-lbs: Ideal 14.7 lbs. Range: 16.1 - 13.2 lbs. Actual: 13.210 lbs.

Test Fuel Size (pcs.)(.75 x 1.5 x 5" Flanges) 1.422 lbs 16 Pcs.

2 x 4's x 16.375 " 3 Pcs 5.844 lbs. 44.24 %

4 x 4's x 16.375 " 2 Pcs 7.366 lbs. 55.76 %

4.975 Kg

Est. Dry Burn Rate (Kg/Hr.) $\frac{13.210 - (13.210 \times .16976)}{2.2046} \times \frac{60}{128}$ = 2.3320 Est. Dry Burn Rate (Kg/Hr)

Est EPA Heat Output(HO_E) (Avg BTU's/Hr) (19,140) X $\frac{63}{100}$ x 2.332 = 28,120 Est Heat Output (HO_E) BTU's/Hr

Comments:

Stove Operating Data
Woodstove Test Data Sheet #9
Cold Start - High Burn

Unit: KUMA ASHWOOD
Run: EPA 1
Date: 2/16/09
Technician(s): ATM JRP PDG
Data Sheet #9 - Rev 1/98-Pg.5

Fire Started: 1330 PST

Warm up and Preburn: Primary Air: Wide open from ignition until the start of the test. At the run setting of wide open until the start of the test. High burn.

Secondary Air: No Controls, Naturally drafted

Secondary Burn/[redacted] Bypass: N/A

Charcoal Bed Preparation: Broke up, raked and leveled the coal bed prior to the addition of each warm up/pre burn fuel charge. Starting 1130 before the start of the test, broke up, raked and leveled the coal bed. In stove for 30 seconds.

Test: Door wide open during loading 0 min 50 sec, then closed.

Primary Air: Wide open from the start of the test (0:00) until the end of the test. High Burn.

Secondary Air: No Controls. Naturally drafted.

Secondary Burn/[redacted] Bypass: N/A

Fan: ON / OFF during the warm up, ON/OFF High during the preburn, ON/OFF at the start of the test, ON/OFF for the first 5 minutes of the test, ON/OFF High at 5 minutes into the test, ON/OFF for the rest of the test.

Test Run Anomalies:

Unit Kuma Ashwood
Run # EPA 1
Date 2/16/09
Technician ATM
Page 1 of 3
WST7-Form2-A, Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-1

Wood Data: Kindling: A mix of the below grades

	Size	Mill	Grade	Species
Pre Burn	2X4	Forest Grove	#2, Std & Btr	D. Fir, Sfc. Grn
Test Fuel	2X4	Forest Grove	#2, Std & Btr	D. Fir, Sfc. Grn
	4X4	Forest Grove	No.1	D. Fir, Sfc. Grn

All grades WCLB Rules unless otherwise noted.

Warm up Information:

1st Warm up/Pre Burn Fuel charge (11.430 lbs) added at 13:46.
2nd Warm up/Pre Burn Fuel charge (12.606 lbs) added at 14:39.
3rd Warm up/Pre Burn Fuel charge (14.212 lbs) added at 15:40.
4th Warm up/Pre Burn Fuel charge (________lbs) added at ________.
5th Warm up/Pre Burn Fuel charge (________lbs) added at ________.
6th Warm up/Pre Burn Fuel charge (________lbs) added at ________.
7th Warm up/Pre Burn Fuel charge (________lbs) added at ________.
8th Warm up/Pre Burn Fuel charge (________lbs) added at ________.

1st Rick 4-12", 4-16" 2X4's 3rd Rick 4-12", 3-16" 2X4's
2nd Rick 8-16" 2X4's H! Barn 3rd Rick 4-12", 5-16" 2X4's

The coals were scooped out of the stove immediately prior to adding the 3rd pre burn/warm up fuel charge. The stove lost 0.0 lbs. 2.0 lbs. of coals were put back in the stove after the scoop.

All pre burn/warm up fuel pieces were either 12 or 16 inches long. All preburn pieces/fuel charges were "ricked" in the stove. The pieces in the bottom layer in each rick contained 2 pcs that were 12 or 16 inches long and were loaded flat and perpendicular to the door. The pieces in the second layer in each rick were loaded on their side (edge) approximately parallel to the door and contained 3 or 4, 5 pcs 16 inches long. The third layer (and fourth layer if present) was loaded flat, perpendicular to the door and contained 2 pcs 12 or 16 inches long. The majority of the pieces in each rick were in the second layer which had an approximate 0.5-1.0" space between pieces. (The loading directions indicate the direction of the longest dimension on each piece relative to the loading door opening.) Each pre burn/warm up fuel charge normally weighs within the weight range allowed for the actual test fuel charge

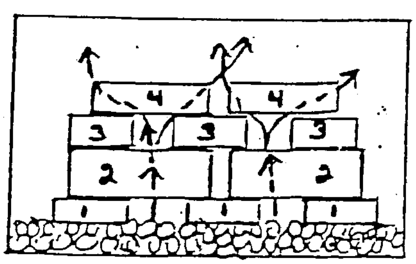
Unit Kuma Ashwood
Run # EPA 1
Date 2/16/09
Technician ATM
Page 2 of 3
WST7-Form2-A, Rev 6/90

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-2

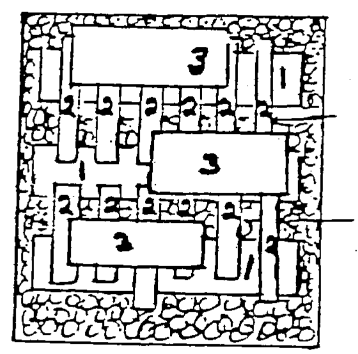
Warm up Information (cont.):

Each warm up/preburn fuel charge was ricked in exactly (as much as possible) the same manner and the weight of each rick was usually within the allowable weight range for the test fuel charge. The physical arrangement and alignment of each rick was designed to accomplish three (3) things: (1)The bottom layer was nestled firmly into the coal bed and was as close to being level with the bottom of the stove as possible, thus providing a stable loading platform for the rest of the rick, keeping it in a ricked state (as opposed to a col- lapsed or fallen down state) untill the rick reached the charcoal stage and sags or collapses of its own accord. (2) It enhances the flow of primary air through the ricked preburn fuel charge, for the primary air would flow through the spaces between the pieces in the first layer and then up through the spaces between the pieces in the second, third and, if present, fourth layers. (3) It maximized, as much as possible, the surface to volume ratio of each preburn fuel charge, thereby allowing the fire immediate access to as much wood surface as possible and, thereby, insuring uniform charcoalization. All three of these enhance combustion and so get the stove as hot as possible during the warm up period, therby maximizing the amount of heat (BTU's) stored in the stove. The actual preburn was not started until the stove surface temperatures had maximized and stabilized, thus indicating that the amount of heat stored in the stove had peaked. For this stove, the thermal storage was monitored using the Stove Top T/C surface temperature(s) and the peak value(s) obtained were 1084 °F.

1026
1084



Front View



Top View

The arrows indicate the direction of the air flow through the rick.

The primary air was adjusted to the run setting of Wide Open 12.9 lbs above the upper charcoal bed weight.

Unit Kuma Ashwood
Run # EPA 1
Date 2/16/09
Technician ATM
Page 3 of 3
WST5-Form2-Rev11/89

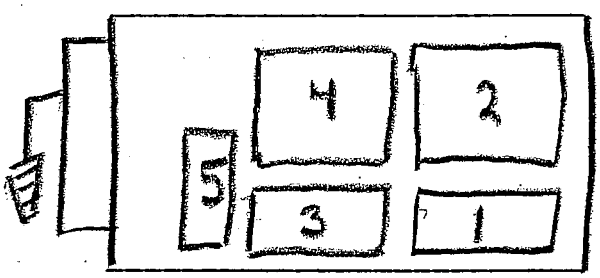
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-3

Additional Comments: Test Start Sequence: (1) Turned Fan Off (2) Opened Door (3) Loaded Fuel (4) cleared coals away from in front of the LPAD (5) Closed door

Total Elapsed Time: 0:50
Photo Taken @ 1:30

Test Fuel Charge Loading Information:

Test Fuel Charge and Loading Sequence Diagram



SIDE of stove view

4 X 4's: 2,4

2 X 4's: 1,3 & 5

Loading Sequence: 1,2,3,4 & 5 last

Driest Pcs in Load 5,3

Loaded the test fuel charge on an essentially level, Medium sized, average/coal coal bed (in appearance, color and temperature for a High burn rate. Load: 0:50 Ignition: ~0:46 Door Closed 0:50 Vertical Column of flame (VC) up to baffle by 0:55.

<1:49 2nd's had ignited.
2:10 2nd's foreward ~~pass~~ front tube
2:40 7.92/.62 Gas Balance ML/L smoke
3:02 Flames/Secondaries full width of pc 4
3:15 " / " " " " pcs 4 & 5
3:50 Front Tube igniting
5:00 Fan On High 11.86/.42 Light smoke.

Unit: Kuma Ashwood
Run: EPA
Date: 2/ 109
Technician: AVM JRP PDG

FUEL MOISTURE
WOODSTOVE TEST DATA SHEET #10

5kg. = 11.024 lbs. 1 kg. = 2.204 lbs

WST1-Form7-Rev11/89

Room Temperature: 65 °F

Correction Factor: +0.5

NOTE: Record readings to the nearest 0.5% moisture
Uncor Values are corrected for temperature: Yes ✓ . No ____
Time Test Fuel Moisture Readings taken at: 1410
Calibration Checks: X ____ Y ____ 12.0 11.8 22.0 22.2

	Pc #	Dimen	Use	Top Uncor	Top Cor	Bottom Uncor	Bottom Cor	Side Uncor	Side Cor	Piece Avg Corrected
	1	3 pcs	K	8.5	8.95	9.0	9.50	8.5	8.95	9.133
	2									
	3									
	4	2X4-8'	P	18.5	19.8	18.5	19.8	20	21.4	20.333
	5	↓	↓	20.5	22.0	21	22.6	19.5	~~20.8~~ 20.9	21.833
	6			18.5	19.8	18.5	19.8	19	20.3	19.967
	7			18.5	19.8	19	20.3	19	20.3	20.133
	8	↓	↓	19	20.3	19	20.3	19	20.3	20.300
	9									102.566
	10									
42	11	2X4-16 3/8"	T	17.5	18.6	18	19.2	18.5	19.8	19.200
1.914	12	↓	↓	19	20.3	20	21.4	20	21.4	21.033
1.390	13	↓	↓	18	19.2	18	19.2	18	19.2	19.200
	14									
3.588	15	4X4-16 3/8"	T	21	22.6	22.5	24.3	17	18.1	21.667
3.430	16	↓	↓	23	21.9	20.5	22.0	15.5	16.5	21.133
	17									102.233
	18									
1.422	19	Spacers	T	19	20.3	19	20.3	20	21.4	20.167
	20								OUT	Spacers

	Kindling	Pretest Fuel	Test Load
% Moisture - Dry Basis:	9.133 %	20.5132 %	20.447 %
% Moisture - Wet Basis:	8.369 %	17.022 %	16.976 %

4X4
13.210 . 7.366

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

1. 11.430
2. 12.606
3. 14.212

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

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

Unit: kuma Ash wood
Run#: EPA 1
Date: 2/ 16 /09
Technician: A.T Myren

WOOD DENSITY DETERMINATION
WOODSTOVE TEST DATA SHEET #11

WST2-form11-Rev 6/90

Wood Piece: Nominal Dimensions: 2X4 3.5" x 1.5" x 3.5"

Depth (D): 3.860 cm

Width (W): 8.865 cm

Length (L): 8.620 cm, 8.740 cm, 8.730 cm, 8.770 cm

Length $\bar{X}$ = 8.715 cm

Volume: 298.218 cm^3 (D X W X L)

MOISTURE: Room Temperature: 65 °F Correction Factor: +0.5

Uncorrected Meter Readings Corrected for temperature: Yes ✓ No ___

NOTE: Record moisture meter readings to the nearest 0.5%

	Uncor	Cor
Top:	15.5	16.5 %
Bottom:	16	17.0 %
Side:	15	15.9 %
$\bar{X}$:		16.467 %

Avg % Moisture (Dry) 16.467 %

Avg % Moisture (Wet) 14.139 %

Scale: Leveled In ✓ Out ___

Zeroed: In ✓ Out ___

Wet Weight: 151.0 g Dry Weight: 129.1 g

% Moisture Dried Basis: 14.503 %
[1 - (Dry Wt ÷ Wet Wt)] X 100

	Date	Time	Temp
Into Dryer	2/16/09	1603	190 °F
Out of Dryer	3/3/09	0915	192 °F

(Minimum Time in Dryer: 24 hrs.) Minimum Dryer Temp 100°C (212°F)

Density = 129.1 g (dry wt) ÷ 298.218 cm^3 (volume) = 0.4329 g/cm^3

Pellet Fuel Moisture Content Determination

Tare Beaker Wt. ________ g

Wet Wt: ________ g - ________ g = ________ g
Gross Wet Wt. Tare Beaker Wt. Net Wet Wt.

Dry Wt: ________ g - ________ g = ________ g
Gross Dry Wt. Tare Beaker Wt. Net Dry Wt.

% Moisture Dried Basis: ________ %
[1 - (Net Dry Wt ÷ Net Wet Wt.)] X 100

Pre Burn 12.9 lbs. l/p
Start WT. 780.0 lbs.
Test Start wt. Range 767.1 - 766.5 lbs.

PRE BURN DATA
RECORD SHEET #13
WST2-Form16

BARO. PRESSURE 28.15" Hg

Unit: Kuma Ashwood
Run: EPA1
Page: 1 of

Date: 2/19/09
Technician(s): ATM GRP PDG

Hot Box On

Minute	Time	Scale Weight	Burn Rate	T/C#-3 Stack	4 Stove Top	5 Left Side	6 Back	7 Right Side	8 Bottom	9 Firebox	10 2nd Burn Front	2nd Burn Center 17	11 Room Temp	Static	Comments
0	1540	780.0	0	350	621	625	531	629	389	808	1099	756	81	-.060	Primary Air Set at W.Op
5	45	778.7	1.3	594	759	572	489	582	376	807	1262	1245	86	-.074	Secondary Air Set at Fixed
10	50	777.1	1.6	655	893	549	421	551	376	844	1347	1277	78	-.075	Fan: On Hi
15	55	775.4	1.7	677	956	540	388	535	355	876	1390	1197	78	-.078	Tunnel on at:
20	1600	773.6	1.8	682	951	544	386	529	344	926	1551	1279	78	-.079	Buckets Iced
25	05	772.0	1.6	678	831	557	377	539	334	994	1639	1337	80	-.076	Analyzers Spanned
30	10	770.6	1.4	672	792	582	372	559	326	1091	1700	1535	84	-.076	Pumps turned on at:
35	15	769.6	1.0	651	717	606	371	578	321	1145	1603	1557	82	-.075	518.6 ΔT ΔΔT
40	20	768.8	.8	637	715	628	376	599	317	1174	1456	1481	86	-.074	527.0 +8.
45	25	768.1	.7	604	819	639	390	611	318	1219	1398	1437	82	-.071	Check WB/DB: 554.4 +27.4
50	30	767.6	.5	562	847	638	404	618	317	1231	1320	1364	85	-.069	564.8 +10.4
55	35	767.3	.3	514	784	633	416	605	318	1169	1314	1322	85	-.064	549.2 -15.
		—													Probe In Tunnel
60	1640	767.0	.3	479	705	613	432	588	320	1114	1190	1196	84	-.061	Tunnel ΔP 531.6 -17.6
65	45	766.9	.1	449	638	585	441	565	322	1022	1063	1065	83	-.059	510.2 -21.4
70	50	766.7	.2	432	583	570	438	545	323	999	1054	1065	83	-.056	489.8 -20.4
75	55	766.6	.1	423	553	543	433	528	322	989	1060	1074	81	-.055	475.8 -14.0
80															
85															
90															

Myren Consulting Inc Data Sheet P1 of 3 Unit Kuma Ashwood Date 2/16/04 Run EPA1
Test Er It 766.6 ΔT 475.8 Barometric Pressure 28.14 "hg Gas Flows @ 1.5" Technician(s) ATM JRF RG

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
0	1655	779.8	13.2	0	.257	6.41		14.11	.076	.76	8.4	ML 5 L	Fan	Off		423	-.055
05	1700	779.0	12.4	.8	.489	12.14		8.54	.044	.44	27.6	"	Fan	ON		523	-.064
10	05	777.9	11.3	1.1	.562	13.94		6.79	.033	.33	42.8	"				575	-.069
15	10	776.7	10.1	1.2	.635	15.75		4.98	.035	.35	45.0	"				613	-.074
20	15	775.6	9.0	1.1	.621	15.40		5.37	.025	.25	61.6	"				613	-.074
25	20	774.6	8.0	1.0	.619	15.35		5.39	.032	.32	48.0	wisps PC 5				619	-.074
30	25	773.7	7.1	.9	.525	13.03		7.79	.016	.16	81.4	" (steam?)				598	-.071
35	30	773.0	6.4	.7	.506	12.56		8.29	.010	.10	125.6	"				577	-.070
40	35	772.3	5.7	.7	.436	10.83		10.02	.011	.11	98.4	Clear				555	-.069
45	40	771.8	5.2	.5	.373	9.27		11.50	.025	.25	37.1	"				522	-.066
50	45	771.3	4.7	.5	.352	8.75		11.97	.036	.36	24.3	" fl c pc 4	Pc 3	thru		506	-.065
55	50	770.9	4.3	.4	.324	8.06		12.61	.046	.46	17.5	"				482	-.064
Tot																6600	-.815

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2^{nd} burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 #19	Tube 3 #20
0	1655	553	543	433	528	322	989	1060	81	126	216	35	68	58	1074			
05	1700	620	547	400	546	354	825	1267	81	137	210	35	72	38	1117			
10	05	731	531	382	528	332	942	1521	81	145	217	35	76	36	1357			
15	10	829	541	352	530	325	1024	1588	81	151	221	35	79	37	1384			
20	15	860	564	332	536	317	1068	1629	83	152	226	35	80	36	1406			
25	20	861	603	314	550	311	1130	1568	83	154	223	35	82	37	1372			
30	25	838	604	305	553	307	1149	1364	84	151	223	35	82	36	1389			
35	30	817	608	300	559	307	1228	1369	84	148	223	35	82	37	1394			
40	35	788	602	297	561	305	1234	1306	84	143	215	35	82	36	1318			
45	40	730	596	295	552	304	1178	1256	83	140	206	35	82	37	1337			
50	45	696	590	294	541	303	1098	1289	83	137	212	35	81	36	1383			
55	50	655	577	291	527	302	1044	1182	82	134	222	35	82	37	1425			
Tot		8978	6906	3995	6511	3789	12,909	16,399	990									

Myren Consulting Inc Data Sheet P2 of 3 Unit Kuma Ashwood Date 2 / 16 / 04 Run EPA 1
Test End 766.6 ΔT 475.8 Barometric Pressure 28.15 ng Gas Flows @ 1.5" Technician(s) ATM JRP POG

Time E/T min	Time	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
60	1755	770.4	3.8	.5	.311	7.74		12.90	.052	.52	14.9	Clear				474	-.062
65	1800	770.0	3.4	.4	.331	8.23		12.50	.034	.34	24.2	"				481	-.063
70	05	769.4	2.8	.6	.358	8.90		11.84	.031	.31	26.7	" 4 brono				490	-.063
75	10	769.0	2.4	.4	.328	8.16		12.58	.031	.31	26.3	"				482	-.062
80	15	768.6	2.0	.4	.325	8.09		12.69	.025	.25	32.3	"				472	-.060
85	20	768.2	1.6	.4	.304	7.57		13.20	.026	.26	29.1	" 4 bell - blowing	6 pA0			452	-.059
90	25	768.0	1.4	.2	.286	7.17		13.54	.037	.37	19.4	"				439	-.058
95	30	767.7	1.1	.3	.277	6.90		13.75	.051	.51	13.5	"				426	-.056
100	35	767.5	.9	.2	.276	6.88		13.72	.060	.60	11.5	"				416	-.055
105	40	767.3	.7	.2	.275	6.85		13.76	.057	.57	12.0	"				413	-.054
110	45	767.1	.5	.2	.204	5.10		15.52	.077	.77	6.6	" OOB				392	-.052
115	50	766.9	.3	.2	.195	4.87		15.56	.094	.94	5.8	"				375	-.050
Tot																5314	.694

Time E/t	Time	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2^{nd} burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 #19	Tube 3 #20
60	1755	628	562	293	518	301	1010	1246	82	133	219	35	81	36	1426			
65	1800	610	540	296	512	299	1009	1283	81	131	220	36	81	38	1403			
70	05	613	538	300	514	296	1026	1316	81	133	220	35	81	36	1474			
75	10	621	545	304	518	294	1014	1301	81	131	221	35	81	36	1375			
80	15	603	545	308	507	292	1029	1293	81	129	221	35	81	36	1490			
85	20	581	538	317	500	290	999	1234	80	126	221	35	81	36	1336			
90	25	558	536	321	496	289	964	1167	80	124	222	35	80	36	1261			
95	30	534	528	327	492	289	937	1130	80	122	225	35	80	36	1197		ΔT	ΔΔT
100	35	515	521	337	489	288	919	1105	80	121	225	35	79	36	1170		430.0	-45.8
105	40	501	514	347	486	288	907	1090	80	120	223	35	79	36	1142			
110	45	480	502	350	482	288	881	947	79	117	223	35	80	36	990			
115	50	456	487	352	477	286	827	921	79	115	222	35	81	36	961		411.0	-64.8
Tot		6720	6356	3852	5988	3502	11502	14033	964									

Myren Consulting Inc Data Sheet P3 of 3 Unit Kuma Ashwood Date 2/16/09 Run EPA1
Test Er Wt. 766.6 ΔT 475.8 Barometric Pressure 28.1" "hg Gas Flows @ 1.5" Technician(s) ATM JRP DQ

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
120	1855	766.8	12	.1	.155	3.88		16.34	.136	.136	2.9	clear.				360	-.049
125	1900	766.7	.1	.1	.139	3.49		16.75	.133	.133	2.6	↓				345	-.048
130 126	1903	766.6	0	.1	.140	3.51		16.71	.136	.136	2.6					339	-.047
135																1044	.144
140														Total		12964	1.653
145														AVG	÷27	480	.061
150																	
155																	
160																	
165																	
170																	
175																	
Tot																	

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2^{nd} burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 #19	Tube 3 #20
120	1855	433	469	351	461	286	800	870	79	113	221	35	82	36	891			
125	1900	409	447	343	443	284	764	813	78	111	216	35	82	36	835			
130 126	1903	400	437	340	435	282	749	806	76	110	215	35	82	36	826			
135		1242	1353	1034	1339	852	2313	2491	235									
140		16920	14615	8880	13838	8143	26721	32923	2189	Total								
145		627	541	329	513	302	990	1219	81	AVG	÷27				Delta	T		
150															Start	475.8	—	
155															Stop	378.8	—	
160															ΔΔT	-97.0	—	
165																		
170																		
175																		
Tot																		

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-1

Site: Myren Consulting, Colville [redacted], WA Date: 2/16/09 Analyte: CO_2

Source: Kuma Ashwood Run #: EPA 1

Zero Cyl #: TC 3AAM154 Conc. 00.0 % CO_2 Cyl Press: 1590 psi

Certified by: Oxarc Date: 11/12/07

Span Cyl #: AS90457 Conc. 12.5 % CO_2 Cyl Press: 1480 psi

Certified by: Matheson Tri Gas Date: 2/2/2009

Analyzer: Make: Horiba Model: PIR-2000 SN: 607024

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

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter: ____

EPA Span Value = 25.0% CO_2

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

Pre Run Audit: By: A. T. Myren Time: 1548 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	.07925	+0.07925	+0.32
Span	50.0	.500	12.500	49.75	.500	12.4105	-0.08953	-0.72

.238 1220

Comments:

Post Run Audit: By: A. T. Myren Time: 1956 Temp: 77 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	00.0	.001	.07925	+0.07925	+0.32
Span	50.0	.500	12.500	49.25	.500	12.4105	-0.08953	-0.72

.237

Comments:

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

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

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

WST6-Form10 Rev 5/96

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-3

Site: Myren Consulting, ~~Woodinville~~ Colville, WA   Date: 2/16/09   Analyte: CO

Source: Kuma Ashwood   Run #: EPA 1

Zero Cyl #: TC3AAM 154   Conc. 00.0 % CO   Cyl Press: 1590 psi

Certified by: Oxarc   Date: 11/12/07

Span Cyl #: AS 90457   Conc. 2.0 % CO   Cyl Press: 1480 psi

Certified by: Matheson Tri Gas   Date: 2/2/2009

Analyzer: Make: [redacted] HORIBA   Model: [redacted] Mexa 311GE   SN: [redacted] GE-30075

Range: 0 - 10.0% CO   Analyzer Output: 0 - 100 mv.

Flow: 1.5 SCFH   Measured by: Rotameter: X   Flowmeter: ____

EPA Span Value = 5.0% CO

EPA Control Limits = +2.5% of 5.0% CO = + 0.125% CO

Pre Run Audit: By: A.T. Myren   Time: 1548   Temp: 72 °F

Audit Results

Point #	Expected Response Meter	Expected Response DVM	Expected Response %	Actual Response Meter	Actual Response DVM	Actual Response %	+ Conc. Difference	Δ %
Zero	00.0	00.0	00.0	0.00	.000	-.00443	-0.00443	-0.04
Span	2.00	.200	2.00	2.00	.201	2.0160	+0.0160	+0.80
Comments:				1.22	.122	1.2219	-.0381	-3.02

Post Run Audit: By: A.T. Myren   Time: 1956   Temp.: 77 °F

Audit Results

Point #	Expected Response Meter	Expected Response DVM	Expected Response %	Actual Response Meter	Actual Response DVM	Actual Response %	+ Conc. Difference	Δ %
Zero	00.0	00.0	00.0	0.00	-.001	-.01448	-0.01448	-0.14
Span	2.00	.200	2.00	2.00	.199	1.9959	-0.04105	-0.21
Comments:				1.21	.121	1.2118	-0.04815	-3.82

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

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

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

Unit Kuma Ashwood
Run EPA
Date 2/ 1 09
Technicians ATM JRP PDG
WSTS-Form3-Rev11/89

QUALITY CHECKS
WOODSTOVE DATA SHEET #16

Ambient = Tr: ____ °F T/C#30: ____ °F

Thermocouple Check (at ambient): T/C#1: — °F; T/C#2: 74.2 °F;

T/C #3: 72.4 °F;	T/C #4: 68.7 °F;	T/C #5: 69.5 °F;
T/C #6: 67.8 °F;	T/C #7: 67.8 °F;	T/C #8: 68.5 °F;
T/C #9: 68.7 °F;	T/C #10: 68.4 °F;	T/C #11: 67.6 °F;
T/C #12: 72.1 °F;	T/C #13: 68.4 °F;	T/C #14: 63.2 °F;
T/C #15: 70.0 °F;	T/C #16: 64.4 °F;	T/C #17: 68.3 °F;
T/C #18: — °F;	T/C #19: ____ °F;	T/C #20: ____ °F;
T/C #21: ____ °F;	T/C #22: ____ °F;	T/C #23: ____ °F;
T/C #24: ____ °F;	T/C #25: ____ °F;	T/C #26: ____ °F;

Comments: ____

Thermocouple Readout: Pretest Zero/Span Check and Calibration:

Zero (0°F): -0.6/.7°F Adj to: — °F Post Test Check Zero (0°F): 0.5 °F % Difference +0.10

Span (2000°F): 2000.9°F Adj to: — °F Span (2000°F): 2002.4 °F +0.10

(Allowable % Difference = 1.5%. Use formulas on Woodstove Data Sheet #15 to calculate % Difference) In Degrees Absolute.

Thermocouple Readout Pretest Linearity Check

0°F = -0. °F;	200°F = 201.3 °F;	400°F = 398.8 °F;
600°F = 601.2 °F;	800°F = 801.5 °F;	1000°F = 1000.8 °F;
1200°F = 1198.5 °F;	1400°F = 1399.7 °F;	1600°F = 1600.3 °F
1800°F = 1800.7 °F;	2000°F = 2000.9 °F	

Combustion Gas (CO_2, O_2, CO) Train Leak Check: Pre ok PDG Post ok PDG

Draft (Static) Guage Zero Check: Pre ok ATM Post ok ATM

Scale Check Pre (Wt, #'s): 773.6 - 768.6 = 5.0 lbs / 5.0 lbs = ok ATM

Post (Wt, #'s): 776.4 - 771.4 = 5.0 lbs / 5.0 lbs = ok ATM

Stack cleaned prior to the run: Yes ✓ No ____

Tunnel cleaned prior to the run: Yes ✓ No ____ (whole tunnel to exhaust outlet)

EPA 3 [illegible] [illegible]N FCT

MYREN CONSULTING CERT[illegible]CATION TEST DATA

DILUTI[illegible] TUNNEL CALCULATIONS

1\25\09, Md=28.56, Bws=4%

	6" Tunnel
File Name:	EPA 3
Manufacturer:	KUMA
Model Number:	ASHWOOD
Lab Name:	MYREN
Test Date:	2\18\09
Run Number:	EPA 3
Meter Box Y Factor:	1.0177
Barometric pressure (in):	28.511
Gas meter temp (ave):	**86**
delta H(avg):	**0.900**
Gas meter initial reading:	159.0010
Gas meter final reading:	287.9860
Front catch (acetone) mg:	16.9 ~~18.9~~
first filter catch (mg):	10
second filter catch (mg):	-15.2
Tunnel Flow (Qsd) (dscfm)	**139.499**
Emission Rate(g/hr):	**0.946**
Emission Rate(M5H) :	**1.738**
Avg. of Delta P Sq. Roots:	**0.2023**
Vs (Avg.)(ft/min):	**817.298**
Tunnel Avg. Temperature (F):	**95.269**
Test time(min):	245
Fuel Load(lb. wet):	13.308
Wood moisture(%wet):	16.602
Burn rate(dry kg/hr):	**1.233**
Sample Volume (dscf)	**121.255**
Avg. Tunnel Static (-inch H2O):	**0.1614**
Room Blank Catch (mg/dscf):	0
Emission Factor (g/kg):	**0.7670**
Pitot Correction Factor:	0.9634
front filter number	710
back filter number	709
Beaker Number:	23
PRELIMINARY RESULTS	
FINAL RESULTS:	AUDITED
DATA SUMMARY	
MODEL:	ASHWOOD
RUN:	EPA 3
DATE:	2\18\09
DBR:	1.233
EMISSION RATE (g/hr)(M5H)	1.7376
EMISSION FACTOR (g/kg):	0.7670
AVG. % PROPORTIONALITY :	95.974

RUN TIME (min)	PITOT DELTAP (- INCH H20)	TNL TEMP (°F)	GAS METER RDG (ft3)	GAS METER TEMP (°F)	GAS METER DELTA H (in.H2O)	TUNNEL VELOCITY (ft/min)	PROP RATE (%)	dDGM vol std (ft3)	Tunnel Static (- Inch H2O)	SQUARE ROOT DELTA P	DRY GAS METER RDG (m3)
0	0.041	94	159.0010	69	0.900	848.31			0.160	0.2025	
10	0.039	105	164.2640	72	0.900	835.52	104.7	5.075	0.152	0.1975	
20	0.040	101	169.4730	75	0.900	843.17	100.8	4.995	0.153	0.2000	
30	0.039	102	174.7030	78	0.900	833.30	101.5	4.987	0.150	0.1975	
40	0.041	102	179.9190	81	0.900	854.41	97.6	4.946	0.163	0.2025	
50	0.042	101	185.1430	83	0.900	864.00	95.8	4.936	0.167	0.2049	
60	0.041	99	190.3670	85	0.900	852.13	96.1	4.917	0.165	0.2025	
70	0.041	99	195.5990	86	0.900	852.13	95.9	4.916	0.164	0.2025	
80	0.042	99	200.8430	87	0.900	862.46	94.6	4.918	0.165	0.2049	
90	0.041	98	206.1000	87	0.900	851.37	95.9	4.930	0.165	0.2025	
100	0.042	98	211.3730	88	0.900	861.69	94.7	4.936	0.166	0.2049	
110	0.042	95	216.6410	88	0.900	859.37	94.3	4.932	0.165	0.2049	
120	0.041	93	221.9120	88	0.900	847.54	95.4	4.935	0.160	0.2025	
130	0.041	91	227.1940	88	0.900	846.01	95.4	4.945	0.162	0.2025	
140	0.041	91	232.4740	89	0.900	846.01	95.0	4.934	0.161	0.2025	
150	0.041	90	237.7560	88	0.900	845.24	95.3	4.945	0.160	0.2025	
160	0.041	91	243.0370	89	0.900	846.01	95.0	4.935	0.162	0.2025	
170	0.041	92	248.3280	89	0.900	846.78	95.3	4.944	0.163	0.2025	
180	0.041	92	253.6110	89	0.900	846.78	95.1	4.937	0.163	0.2025	
190	0.041	92	258.9020	90	0.900	846.78	94.9	4.935	0.164	0.2025	
200	0.041	91	264.1860	90	0.900	846.01	94.7	4.929	0.161	0.2025	
210	0.041	91	269.4770	90	0.900	846.01	94.9	4.935	0.160	0.2025	
220	0.041	92	274.7560	90	0.900	846.78	94.7	4.924	0.162	0.2025	
230	0.041	92	280.0500	90	0.900	846.78	95.0	4.938	0.163	0.2025	
240	0.041	93	285.3390	90	0.900	847.54	95.0	4.933	0.161	0.2025	
245	0.041	93	287.8960	90	0.900	847.54	91.8	2.385	0.160	0.2025	
			0.0000			0.00	0.0	0.000		0.0000	
270			0.0000			0.00	0.0	0.000		0.0000	
280			0.0000			0.00	0.0	0.000		0.0000	
290			0.0000			0.00	0.0	0.000		0.0000	
300			0.0000			0.00	0.0	0.000		0.0000	
310			0.0000			0.00	0.0	0.000		0.0000	
320			0.0000			0.00	0.0	0.000		0.0000	
330			0.0000			0.00	0.0	0.000		0.0000	
340			0.0000			0.00	0.0	0.000		0.0000	
350			0.0000			0.00	0.0	0.000		0.0000	
360			0.0000			0.00	0.0	0.000		0.0000	
370			0.0000			0.00	0.0	0.000		0.0000	
380			0.0000			0.00	0.0	0.000		0.0000	

METHOD 5G-1 (EPA) PARTICULATE SAMPLING DATA **Rev. 2/09**

DATE: 2/18/09 **PAGE** 1 **OF** 2 **UNIT:** Kuma Ashwood **RUN:** EPA 3

METER BOX: 45G-P **METER Y:** 1.0177 **FILTER #'S: (F)** 710 **(R)** 709

.750/.752
PRE TEST LEAK CHECK: .002 **CFM @** -15.6 **IN HG** **FILTER SIZE:** 110 **mm**

1054/1059
POST TEST LEAK CHECK: .005 **CFM @** -15.1 **IN HG** **PROBE LENGTH** 21.0 **IN**

TIME		METER READING (FT^3)	PITOT		TUNNEL TEMP (°F)	METER TEMP (°F)	GAS METER Δh	VAC (in Hg)
CLOCK	ELAPSED		ΔP	Pg				
1155	00	159.001	.041	-.160	94	69	.90	0
1205	10	164.264	.039	-.152	105	72	.90	0
15	20	169.473	.040	-.153	101	75	.90	0
25	30	174.703	.039	-.150	102	78	.90	0
35	40	179.919	.041	-.163	102	81	.90	0
45	50	185.143	.042	-.167	101	83	.90	0
55	60	190.367	.041	-.165	99	85	.90	0
1305	70	195.599	.041	-.164	99	86	.90	0
15	80	200.843	.042	-.165	99	87	.90	0
25	90	206.100	.041	-.165	98	87	.90	0
35	100	211.373	.042	-.166	96	88	.90	0
45	10	216.641	.042	-.165	95	88	.90	0
55	120	221.912	.041	-.160	93	88	.90	0
1405	30	227.194	.041	-.162	91	88	.90	0
15	40	232.474	.041	-.161	91	89	.90	0
25	50	237.756	.041	-.160	90	88	.90	0
35	60	243.037	.041	-.162	91	89	.90	0
45	70	248.328	.041	-.163	92	89	.90	0
55	180	253.611	.041	-.163	92	89	.90	0
1505	90	258.902	.041	-.164	92	90	.90	0

BP

00	28.51	255	28.515
60	28.505		
120	28.51		
180	28.51		
240	28.515	AVG. =	28.51

Pre Test Filter Check Weighing
F .6594
R .6809

End of Test Weight
F .6699 R .6656
.6590 .6806
.0109 0

METHOD 5G - 1 (EPA) PARTICULATE SAMPLING DATA **Rev. 2/09**

DATE: 2/16/09 **PAGE** 2 **OF** 2 **UNIT:** Kuma Ashwood **RUN:** EPA 3

METER BOX: 45G-P **METER Y:** 1.0177 **FILTER #'S: (F)** 710 **(R)** 709

.750/.752
PRE TEST LEAK CHECK: .002 **CFM @** -15.6 **IN HG** **FILTER SIZE:** 110 **mm**

.054/.059
POST TEST LEAK CHECK: .005 **CFM @** -15.1 **IN HG** **PROBE LENGTH** 21.0 **IN**

TIME		METER READING (FT³)	PITOT		TUNNEL TEMP (°F)	METER TEMP (°F)	GAS METER Δh	VAC (in Hg)
CLOCK	ELAPSED		ΔP	Pg				
1515	200	264.186	.041	-.161	91	90	1.90	0
25	10	269.477	.041	-.160	91	90	1.90	0
35	20	274.756	.041	-.162	92	90	1.90	0
45	30	280.050	.041	-.163	92	90	1.90	0
55	240	285.339	.041	-.161	93	90	1.90	0
1600	~~50~~ 245	287.986	.041	-.160	93	90	1.90	0
	60							
	70							
	80							
	90							
	00							
	10							
	20							
	30							
	40							
	50							
	60							
	70							
	80							
	90							

BP

00	28.51	255	28.515
100	28.505		
120	28.51		
180	28.51		
240	28.515	AVG.=	28.510

Pre Test Filter Check Weighing
F .6594
R .6809

End of Test Weight
F .6590 R .6806

MYREN CONSULTING, INC.

Dilution Tunnel Traverse Data with 8 Traverse Points

Unit: Kuma Ashwood
Run #: EPA 3
Date: 2/ 18 /09
Technicians:

Rev 4/2/08

Point	Location	Δp	$\sqrt{\Delta p_{trav}}$	Δp	$\sqrt{\Delta p_{cent}}$	T_{trav} 12	T_{cent} 12	Pg
W-1	0.5"	.033	.1817			104		
2	1.5	.039	.1975			105		
Center	Center			.041	.2025		104	-.160
3	4.5	.040	.2000			104		
4	5.5	.038	.1949			103		
S-1	0.5	.037	.1924			101		
2	1.5	.039	.1975			101		
Center	Center			.040	.2000		101	-.157
3	4.5	.039	.1975			101		
4	5.5	.036	.1897			100		
	Totals		1.5512		.4025	819	205	-.317
	Average		.1939		.20125	102.375	102.5	-.1585
	°R = (°F + 460)				//	562.4	562.5	

Ps = BP + (-Pg/13.6) = 28.51 + (-.1585/13.6) = 28.498 "Hg

LEAK CHECKS:

Pre Test: Pg Leg: ✓ JRP Velocity Head Leg: ✓ JRP

Post Test: Pg Leg: ✓ PDH Velocity Head Leg: ✓ PDH

DILUTION TUNNEL GAS VELOCITY & VOLUMETRIC FLOW RATE CALCULATIONS Rev 4/19/08

UNIT: Kuma Ashwood DATE: 2/18/09 RUN #: EPA 3 TECHNICIAN(S): AJM JRP PDG

Average Gas Velocity in the Dilution Tunnel Vstrav (EPA M2 EQN 2-9, ASTM E 2515-07 EQN 7)

(9) $V_{strav} = (85.49)(\underset{\{2\}}{\underline{0.99}}\ cp)(\underset{\{2\}}{\underline{.1939}}\ \overline{x}\ \sqrt{\Delta P}\ ''H_2O)\sqrt{\dfrac{\underset{\{0\}}{\underline{562.4}}\ Ts\ °A}{(\underset{\{2\}}{\underline{28.498}}\ Ps\ ''Hg)(\underline{28.56}\ lb./\ lb.\ mole)}} = \underset{\{2\}}{\underline{13.64158}}\ fps$

(9A) $Vs = (\underset{\{2\}}{\underline{13.64158}}\ fps)(60) = \underset{\{2\}}{\underline{818.495}}\ fpm$

Gas Velocity in the Center of the Dilution Tunnel - Vscent (EPA M2 EQN 2-9, ASTM E 2515-07 EQN 7)

(9) $Vscent = (85.49)(\underset{\{2\}}{\underline{0.99}}\ cp)(\underset{\{2\}}{\underline{.20125}}\ \overline{x}\ \sqrt{\Delta P}\ ''H_2O)\sqrt{\dfrac{\underset{\{0\}}{\underline{562.5}}\ Ts\ °A}{(\underset{\{2\}}{\underline{28.498}}\ Ps\ ''Hg)(\underline{28.56}\ lb./\ lb.\ mole)}} = \underset{\{2\}}{\underline{14.15994}}\ fps$

(9A) $Vs = (\underset{\{2\}}{\underline{14.15994}}\ fps)(60) = \underset{\{2\}}{\underline{849.596}}\ fpm$

EPA M5G1 Section 4.2.2, ASTM E 2515-07 EQN 1 Adjustment Factor for Center of Tunnel Pitot Tube Location

$Fp = Vstrav/\ Vscent = \underline{13.64158} \div \underline{14.15994} = \underline{0.9634}$

Average Stack Gas Dry Volumetric Flow Rate - Qsd (EPA M2 EQN 2-10, ASTM E 2515-07 EQN 3)

(10) $Qsd = 3600(1 - \underline{0.04}\ Bws)(\underset{\{2\}}{\underline{13.6416}}\ fps)(\underset{\{3\}}{\underline{.1963}}\ ft^2)[(528\ °A)(\underset{\{2\}}{\underline{28.498}}\ Ps\ ''Hg)/(\underset{\{0\}}{\underline{562.4}}\ T_s\ °A)(29.92''\ Hg) =$

$\underset{\{1\}}{\underline{8275.624}}$ dscfhr (or dscfh)

(10A) $\underset{\{1\}}{\underline{8275.624}}$ dscfhr ÷ 60 = $\underset{\{1\}}{\underline{137.927}}$ dscfmin (or dscfm)

Note: Number in { } under blank lines denotes number of decimals to be used. If a blank calls for an answer already calculated, use the number of decimals previously specified for that answer.

WST5-Form9,Pg2,Rev1/90

WOODSTOVE DATA SHEET #4-1: INITIAL FILTER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date 1-20-09 Time 1149 By PDG Front Half X Back Half X

Manufacturer: Pall P/N 60115 Size: 110 Lot.No.: 70726 Grade: A/E Glass

Filter #	First Wt	2009 Date	Time	By	Second Wt	Date	Time	By	Third Wt	2009 Date	Time	By
700	.6873	1-22	1331	JRP	.6877	1-23	1417	PDG				
701	.6871		1330	JRP	.6878		1419	PDG	.6877	1.26	1421	JRP
702	.6816		1329	JRP	.6825		1420	PDG	.6824	1.26	1420	JRP
703	.6761		1328	JRP	.6762		1421	PDG				
704	.6727		1327	JRP	.6732		1422	PDG				
705	.6833		1326	JRP	.6837		1423	PDG				
706	.6946		1325	JRP	.6948		1424	PDG				
707	.6773		1324	JRP	.6777		1425	PDG				
708	.6701		1323	JRP	.6702		1426	PDG				
709	.6799		1322	JRP	.6809		1427	PDG	.6806	1.26	1419	JRP
710	.6587		1321	JRP	.6590		1428	PDG				
711	.6654		1320	JRP	.6656		1429	PDG				
712	.6688		1319	JRP	.6892		1430	PDG				
713	.6864		1318	JRP	.6866		1431	PDG				
714	.6651		1318	JRP	.6655		1432	PDG				
715	.6741		1317	JRP	.6744		1433	PDG				
716	.6592		1316	JRP	.6590		1434	PDG				
717	.6531		1315	JRP	.6536		1435	PDG				
718	.6621		1314	JRP	.6623		1436	PDG				
719	.6769		1313	JRP	.6769		1437	PDG				
720	.6627		1312	JRP	.6628		1438	PDG				
721	.6567		1311	JRP	.6569		1439	PDG				
722	.6539		1310	JRP	.65340		1440	PDG				
723	.6552		1309	JRP	.6552		1441	PDG				
724	.6655		1308	JRP	.6656		1442	PDG				

Checked by A.T. Myers Date: 1/27/09 Time 1632

QA REWEIGH

Filter #	WT	Date	Time	By
703	.6761	1/27/09	1639	ATM
708	.6705	"	1640	ATM
715	.6744	✓	1642	ATM

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
57	72	38	1-22-09	1138	ATM
58	75	33	1-23-09	1150	PDG
56	76	25	1-26-09	1359	JRP
58	72	31	1/27/09	1530	PDG

Post	1-22	1/23	1.26
0.0000	0.0000	0.0000	0.0000
100.0000	99.9994	99.9993	99.9993

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date: 01.26.09 Time: 15:38 By: JRP

Beaker #	First Wt	2009 Date	Time	By	Second Wt	2009 Date	Time	By	Third Wt	Date	Time	By
20	73.3181	1/27	1532	PDG	73.3176	1·29	1459	JRP		1/30		
21	71.0021		1534	PDG	71.0018		1458	JRP				
22	71.8343		1535	PDG	71.8338		1457	JRP				
23	70.7390		1536	PDG	70.7389		1455	JRP				
27	72.3310		1538	PDG	72.3307		1500	JRP				
31	69.6672		1539	PDG	69.6669		1501	JRP				
32	53.6002		1541	PDG	53.5993		1502	JRP	53.5998		1305	PDG
37	53.7267		1542	PDG	53.7262		1504	JRP				
38	53.2525		1544	PDG	53.2516		1505	JRP	53.2520		1308	PDG
39	53.1509		1545	PDG	53.1493		1506	JRP	53.1496		1311	PDG
40	53.4626		1547	PDG	53.4622		1507	JRP				
41	52.8371		1549	PDG	52.8367		1508	JRP				
42	53.8699		1550	PDG	53.8692		1509	JRP	53.8696		1302	PDG

Checked By: AFM Date: 2/1/09 Time: 1210

QA REWEIGH

Beaker #	WT	Date	Time	By
20	73.3181	2/1/09	1215	AFM
31	69.6671		1217	AFM
42	53.8699		1219	AFM

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	2009 Date	Time	By
55	72	31	1/27	1530	PDG
58	77	29	1·29	1436	OMP
60	72	49	1/30	1256	PDG
58	74	37	2/1	1200	AFM

PUA

1/27	1·29	1/30	2/1
0.0000	0.0000	0.0000	0.0000
99.6004	[illegible]	[illegible]	[illegible]

WST5-Form9, Pg3, Rev6/90

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Blank done 12/10/07

Into Dessicator: Date: 10/12/07 Time: 0801 By: GRP

Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
22	71.8343	10/22/07	1358	GRP	71.8332	11/10/07	1938		71.8330	11-11-07	1748	Dm
24	73.2192		1400	GRP	73.2190	11/10/07	1940		73.2193	11-11-07	1746	Dm
25	72.6516		1401	GRP	72.6512	11/10/07	1944	← Blank				
26	71.7895		1403	GRP	71.7888	11/10/07	1939		71.7886	11-11-07	1747	Dm
27	72.3316		1402	GRP	72.3314	11/10/07	1945					
28	70.5979		1404	GRP	70.5975	11/10/07	1941		70.5977	11-11-07	1745	Dm
39	53.1508		1405	GRP	53.1500	11/10/07	1942					
37	53.7237	11/10/07	1945	AM	53.7238	11/11/07	1743	Dm				

Checked By: Date: Time:

QA REWEIGH

Beaker #	WT	Date	Time	By
27	72.3315	11-11	1740	Dm
25	72.6515	11-11	1741	Dm
39	53.1509	11-11	1744	Dm

2nd

Post weighing 0.0000g

LSD 0.0000

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
57	68	50	10/22/07	1344	GRP
			11/10		

WST5-Form9 Rev4/90
Unit Kuma Ashwood
Run # EPA 3
Date: 2/18/09

WOODSTOVE DATA SHEET #4-3: CC TANT FINAL WEIGHTS

60 ml.

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
23	70.7582	2/21	1542	ATM	70.7578	2/22	1237	[illegible]	70.7566	2/23	1408	PDG	70.7553	2/24	1010	ATM
					Fourth											
					70.7559	2/25	1132	PDG	70.7558	2.26	1329	JRP				

2009

FINAL FILTER WEIGHTS

	Filter #	Into Dessic	Date	Time	By	First	2009 Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
F	710	.6699	2/18	1850	ATM	.6691	2.19	1321	JRP	.6690	2/20	1046	PDG				
R	709	.6656	2/18	1850	ATM	.6654	2.19	1322	JRP	.6654	2/20	1030	PDG				

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By
Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	2009 Date	Time	By	WB	DB	%RH
1	2-19	1248	JRP	56	73	32
2	2/20	1018	PDG	57	74	33
3	2/22	1222	ATM	47	59	37
4	2/23	1406	PDG	58	70	48
5	2/24	0953	ATM	59	75	35

SCALE ROOM ENVIRONMENTAL CONDITIONS

6	2.25	1123	PDG	60	74	38
7	2.26	1258	JRP	55	70	36
8						
9						

Comments

Ara Done
Lot #
041648

WST5-Form9, Pg1, Rev4/90
Unit Kuma Ashwood
Run # EPA 3
Date: 2/10/09

Blank done 12/10/07

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

Tare 72.6512

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	2007 Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
25	✓	12/12	1546	JRP	72.6508	12/13	1342	JRP	72.6511	12/14	1347	Jn				

FINAL FILTER WEIGHTS

Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By

Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	2007 Date	Time	By	WB	DB	%RH
1	12/13	1307	JRP	55	73	29
2	12/14	1321	JRP	57	75	31
3						
4						

SCALE ROOM ENVIRONMENTAL CONDITIONS

6						
7						
8						
9						

Comments

WOODSTOVE DATA SHEET 4-4 SCALE QC RECORD SHEET

FROM: 9/27/2007
THROUGH: 12/7/2007

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

Level	Recalibrated	130 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	129.9998	99.9998	10.0000	1.0000	0.1000	0.0199	9/27/07	1402	GRP	55	67	45
✓	Y	129.9995	99.9996	10.0001	1.0000	0.1000	0.0200	9/28/07	1335	GRP	57	69	46 ATM
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0200	10/1/07	1505	ATM	58	70	48
✓	N	129.9995	99.9996	10.0000	1.0001	0.1000	0.0199	10/2/07	1611	GRP	56	68	46
✓	N	129.9997	99.9997	9.9999	1.0001	0.1000	0.0199	10/3/07	1122	GRP	56	68	46
✓	N	129.9996	99.9996	10.0000	1.0000	0.0999	0.0199	10/4/07	1225	GRP	55	67	45
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	10/5/07	0750	GRP	51	62	45
✓	N	129.9997	99.9997	9.9999	1.0000	0.1000	0.0199	10/5/07	1513	GRP	56	69	43
✓	Y	129.9996	99.9996	10.0000	1.0001	0.1001	0.0200	10/9/07	1505	ATM	58	71	44
✓	N	129.9996	99.9997	10.0000	1.0001	0.1001	0.0200	10/12/07	1259	ATM	58	70	48
✓	Y	129.9995	99.9996	9.9999	1.0000	0.1000	0.0199	10/22/07	1344	GRP	57	68	50
✓	Y	129.9996	99.9997	9.9999	1.0000	0.1000	0.0199	10/29/07	1338	GRP	53	63	50
✓	N	129.9995	99.9995	10.0000	1.0000	0.1000	0.0200	10/30/07	0933	ATM	56	70	40
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1000	0.0199	10/30/07	1457	GRP	55	70	36
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	10/31/07	1528	GRP	57	75	30
✓	Y	129.9996	99.9996	9.9999	1.0000	0.0999	0.0199	11/2/07	1238	GRP	52	67	33
✓	Y	129.9996	99.9996	10.0000	1.0001	0.1000	0.0199	11/5/07	0730	GRP	57	73	35
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1001	0.0201	11/9/07	1550	ATM	58	70	48
✓	N	129.9996	99.9997	10.0000	1.0000	0.1000	0.0200	11/10/07	1835	ATM	58	71	44
✓	Y	129.9997	99.9997	9.9999	1.0000	0.1000	0.0199	11/11/07	1810	ATM	55	69	39
✓	N	129.9997	99.9996	9.9999	1.0000	0.1000	0.0199	11/12/07	0822	GRP	54	67	41
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	11/13/07	1226	ATM	58	72	41
✓	N	129.9998	99.9997	9.9999	0.9999	0.1000	0.0200	11/14/07	1710	GRP	58	73	39
✓		QC Services Audit 11/14/07											
✓	Y	129.9997	99.9997	10.0000	1.0000	0.1000	0.0200	11/15/04	1358	ATM	59	72	45
✓	N	129.9996	99.9996	9.9999	0.9999	0.1000	0.0200	11/16/07	1600	GRP	58	71	44
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	11/18/07	1758	ATM	60	74	43
✓	Y	129.9997	99.9997	10.0000	1.0001	0.1001	0.0200	11/19/07	1143	ATM	56	70	40
✓	Y	129.9995	99.9996	10.0000	1.0000	0.1000	0.0199	11/20/07	1416	GRP	54	69	35
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	11/27/07	1110	ATM	57	70	44
✓	N	129.9995	99.9996	10.0000	1.0000	0.1000	0.0199	12/3/07	0730	GRP	55	69	40
✓	N	129.9996	99.9996	10.0000	1.0000	0.0999	0.0200	12/6/07	1125	ATM	54	67	44
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/7/07	1348	GRP	55	69	40

WOODSTOVE DATA SHEET 4-4 SCALE QC RECORD SHEET

FROM: 12/8/07
THROUGH: 2/3/08

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

Level	Recalibrated	130 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/8	1215	ATM	57	73	35
✓	N	129.9996	99.9996	10.0000	1.0000	0.1001	0.0200	12/8	1910	ATM	57	72	38
✓	N	129.9997	99.9996	10.0000	1.0000	0.1000	0.0199	12/9	1935	ATM	55	72	31
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/10	1953	ATM	56	72	34
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/11	1618	GRP	57	76	28
✓	N	129.9997	99.9996	10.0000	1.0000	0.0999	0.0199	12/12	1505	GRP/[illegible]	56	74	30
✓	N	129.9996	99.9996	9.9999	0.9999	0.1000	0.0199	12/13	1307	GRP	55	73	29
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	12/14	1321	GRP	57	75	31
✓	N	129.9998	99.9998	9.9999	1.0001	0.1000	0.0199	12/15	1602	GRP	57	75	31
✓	Y	129.9996	99.9997	9.9999	1.0000	0.1000	0.0199	12/17	0817	GRP	55	73	29
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/18	0853	GRP	58	75	34
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/19	0812	GRP	55	72	31
✓	Y	129.9995	99.9996	10.0000	1.0001	0.0999	0.0199	12/20	0916	GRP	57	71	41
✓	Y	129.9998	99.9997	10.0000	1.0000	0.1000	0.0199	12/21	1085	ATM	55	70	36
✓	N	129.9997	99.9996	10.0000	1.0000	0.10000	0.0200	12/22	1434	[illegible]	54	66	44
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/23	0915	ATM	57	70	44
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	12/26	1230	ATM	57	70	44
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0200	12/27	1030	ATM	56	72	34
✓	N	129.9998	99.9997	9.9999	1.0000	0.1000	0.0200	1/8/08	1342	GRP	54	68	38
✓	N	129.9997	99.9997	10.0000	1.0001	0.1000	0.0200	1/9/08	0742	GRP	55	70	36
✓	N	129.9998	99.9998	10.0000	1.0000	0.1000	0.0199	1/11/08	1040	ATM	59	73	42
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1000	0.0199	1/16/08	1221	GRP	51	72	18
✓	N	129.9999	99.9998	10.0000	1.0000	0.1000	0.0199	1/17/08	1237	GRP	56	71	37
✓	N	129.9998	99.9998	10.0000	1.0000	0.0999	0.0200	1/18/08	1116	GRP	56	71	37
✓	Y	129.9995	99.9996	9.9999	1.0001	0.1000	0.0199	1/21/08	1426	GRP	56	72	34
✓	N	129.9995	99.9996	10.0000	1.0001	0.1000	0.0199	1/22/08	1513	GRP	56	71	37
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	1/23/08	0805	GRP	54	69	36
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	1/24/08	0758	GRP	54	70	33
✓	N	129.9998	99.9997	10.0000	1.0000	0.1000	0.0199	1/24/08	1450	GRP	56	71	37
✓	N	129.9997	99.9996	10.0000	1.0000	0.1000	0.0200	1/31/08	1505	GRP	55	69	38
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	2/1/08	1029	GRP	54	69	36
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	2/2/08	1620	ATM	58	72	41
✓	N	129.9996	99.9997	10.0000	1.0001	0.1000	0.0200	2/3/08	1710	ATM	57	70	44

WOODSTOVE DATA SHEET 4-4 ANALYTICAL BALANCE QC RECORD SHEET

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

FROM: 12/20/08
THROUGH: 2/17/09

Level	Recalibrated	140 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	12/20/08	1430	ADM	58	72	42
✓	N	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	12/23/08	1057	JRP	60	76	38
✓	N	139.9994	99.9994	9.9999	1.0001	0.1000	0.0200	12/24/08	1019	ATM	59	72	45
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0200	12/26/08	1142	ATM	59	72	45
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0200	12/28/08	1050	ATM	60	75	37
✓	N	139.9994	99.9994	10.0000	.9999	0.1000	0.0199	1/05/09	1157	PDG	58	75	34
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	1/6/09	1845	ATM	60	75	37
✓	N	139.9995	99.9996	9.9999	1.0000	0.1000	0.0199	1/7/09	1530	JRP	58	70	48
✓	N	139.9994	99.9994	9.9999	.9999	0.1000	0.0199	1/8/09	1356	PDG	60	72	49
✓	Yes	139.9993	99.9994	9.9999	1.0000	0.1000	0.0200	1/09/09	1053	PDG	58	72	42
✓	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	1/11/09	1128	JRP	55	72	31
✓	Yes	139.9994	99.9995	9.9999	1.0000	0.1000	0.0199	1/12/09	0845	PDG	59	75	38
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0200	1/13/09	0825	JRP	58	74	37
✓	yes	139.9993	99.9994	9.9999	0.9999	0.1000	0.0199	1-14-09	1212	PDG	57	72	38
✓	NO	139.9993	99.9993	9.9999	1.0000	0.0999	0.0199	1/14/09	1420	JRP	59	75	37
✓	NO	139.9992	99.9993	10.0000	1.0000	0.0999	0.0199	1-15-09	1128	JRP	58	74	37
✓	yes	139.9994	99.9995	9.9999	0.9999	0.1000	0.0199	1-20-09	0950	PDG	58	74	37
✓	no	139.9993	99.9994	10.0000	0.9999	0.1000	0.0199	1-20-09	1230	PDG	56	71	37
✓	NO	139.9993	99.9993	9.9999	1.0000	0.0999	0.0199	1-20-09	1613	JRP	57	73	35
✓	No	139.9994	99.9994	9.9999	1.0000	0.1001	0.0200	1/22/09	1138	ATM	57	72	38
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	1/23/09	1150	PDG	58	75	33
✓	YES	139.9992	99.9993	10.0000	1.0000	0.0999	0.0200	1/26/09	1359	JRP	56	76	25
✓	no	139.9994	99.9995	10.0000	1.0000	0.1000	0.0199	1/27/09	1530	PDG	55	72	31
✓	No	139.9993	99.9993	10.0000	1.0001	0.1001	0.0200	1/28/09	1452	ATM	61	75	41
✓	YES	139.9993	99.9994	10.0000	1.0000	0.1000	0.0199	1-29-09	1436	JRP	58	77	29
✓	no	139.9995	99.9995	9.9999	0.9999	0.1000	0.0199	1/30/09	1256	PDG	60	72	49
✓	yes	139.9993	99.9994	9.9999	1.0000	0.1000	0.0199	2/1/09	1200	ATM	58	74	37
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	2/2/09	1350	JRP	58	77	29
✓	yes	139.9995	99.9996	9.9999	1.0000	0.1000	0.0199	2/5/09	1118	PDG	59	72	45
✓	NO	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	2/6/09	1150	JRP	57	74	33
✓	No	139.9994	99.9994	10.0000	1.0001	0.1000	0.0200	2/9/09	1015	ATM	49	70	19
✓	NO	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	2/16/09	1551	PDG	61	78	36
✓	NO	139.9993	99.9994	9.9999	1.0000	0.1000	0.0200	2/17/09	1439	JRP	56	72	35

WOODSTOVE DATA SHEET 4-4 ANALYTICAL BALANCE QC RECORD SHEET

FROM: 2/10/09
THROUGH:

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

Level	Recalibrated	140 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
Y	Y	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	2/10/09	1800	ATM	55	70	36
Y	Y	139.9993	99.9994	9.9999	1.0000	0.1000	0.0199	2-19-09	1248	JRP	56	73	32
Yes	Y	139.9993	99.9994	9.9999	0.9999	0.1000	0.0199	2/20/09	1018	PDG	57	74	33
Yes	Y	139.9993	99.9994	10.0000	1.0000	0.1000	0.0200	2/21/09	1519	ATM	60	77	35
Yes	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	2/22/09	1222	ATM	47	59	37
Y	Yes	139.9994	99.9994	9.9999	0.9999	0.1000	0.0199	2/23/09	1406	PDG	58	70	48
Yes	No	139.9994	99.9991	9.9999	1.0000	0.1000	0.0200	2/24/09	0953	ATM	59	76	35
Yes	Yes	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	2/25/09	1123	PDG	60	76	38
Yes	Yes	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	2-26-09	1258	JRP	55	70	36
YES	YES	139.9993	99.9993	9.9999	1.0001	0.1001	0.0200	2/28/09	1330	ATM	57	74	33
Yes	Yes	139.9995	99.9995	9.9999	0.9999	0.1000	0.0199	3/3/09	1431	PDG	59	76	35
Yes	NO	139.9993	99.9995	9.9999	1.0000	0.1000	0.0199	3/4/09	1556	JRP	56	70	40
Yes	No	139.9994	99.9994	9.9999	1.0001	0.1001	0.0200	3/5/09	1350	ATM	60	75	40
Yes	No	139.9993	99.9993	9.9999	1.0000	0.1000	0.0200	3/7/09	0850	ATM	57	71	41
Yes	Yes	139.9993	99.9993	10.0000	1.0001	0.1000	0.0200	3/8/09	1323	ATM	55	70	36
Yes	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	3/10/09	1212	PDG	50	75	10

Woodstove Particulate
Catch Processing Sheet
Woodstove Data Sheet #5
EPA M5G-1

Unit : Kuma Ashwood
Run: EPA 3
Date: 2/18/09
Technicians: A.T.,M
Revised 1/16/98-Data Sheet #5

Filters

Filter # (Front) 710 ~~Beaker #~~ 23
Final Wt. .6690 g ~~Ml~~ 60
Tare Wt. .6590 g ~~Desc.~~ Acetone
Net Wt. .0100 g

Final Wt. ~~70.7558~~ g 70.7553
Tare Wt. 70.7389 g
Net Wt. .0169 g 16.4

Filter # (Rear) 709 Beaker # ______
Final Wt. .6654 g ~~Ml~~ ______
Tare Wt. .6806 g ~~Desc.~~ ______
Net Wt. -.0152 g

Final Wt. ______ g
Tare Wt. ______ g
Net Wt. ______ g

Acetone Blank Calculation: Blank Date: 12/8/07

Blank Beaker # 25 Final Wt. 72.6511 g
Ml 50 Tare Wt. 72.6512 g
Desc. Acetone Net Wt. -0.0001 g = 0.0000

0.0000 g ÷ 50 ml = 0.00000 g/ml

Blank Residue Value Calculation:

0.00000 g/ml acetone X 60 ml acetone = 0.0000 g
Blank Residue Value

Total Particulate Catch Calculation

Filter: .0100 g
Filter: -.0152 g
Beakers: .0169 g -- 0.0000 g = .0169 g
Total Catch Blank Residue Value

Total Catch = .0117 g

Unit Kuma Ashwood
Run # EPA 3
Date 2/18/09
Technician ATM JRP PDG
WST6-Form1,Rev8/96

MISCELLANEOUS TEST DATA
WOODSTOVE DATA SHEET #8

Useable Firebox Dimensions: See QC Section Useable Volume: 2.094 ft^3

Dilution Tunnel Draft (If applicable): Start .000 Stop .000 "H_2O

Test Chamber Air Velocity: Start: 00.0 Stop: 000 Avg: 00.0 ft/MIN

Wet Bulb/ Start: WB: 59 °F DB: 70 °F 0.85% Amb Moisture 52 %RH

Dry Bulb Stop: WB: 60 °F DB: 71 °F 0.90% Amb Moisture 52 %RH

$\bar{X}$ = 0.875 % Ambient Moisture $\bar{X}$ = 52.0 % Relative Humidity (RH)

Empty Stove Wt: 440.2 lbs.

Empty Stove Wt with Stack (Inc. Oil Seal) Wet: 763.9 lbs. Dry: 763.8 lbs. 765.8

Empty Stove Wt with Stack and Ash Ash: — lbs. Total: — lbs.

Kindling Wt. TOTAL 4.9 lbs. Paper: .3 lbs. Wood: 4.6 lbs.

Pre Burn Fuel Wt. 10.360 + 12.574 + 10.676 Total: 33.610 lbs.

Total Kindling and Pre Burn Fuel Wt 38.510 lbs.

Coal Bed Wt-lbs: Range (3.3 - 2.7) 767.1 - 766.5 lbs. Actual 2.9 lbs. 766.7

Allowable Amount of Charcoal that can be removed:

Coal Bed Wt. Range (3.3 Upper Wt. + 2.7 Lower Wt. /2) X .25 = 0.75 lbs. 0.7

Test Fuel Wt-lbs: Ideal 14.7 lbs. Range: 16.1 - 13.2 lbs. Actual: 13.308 lbs.

Test Fuel Size (pcs.) (.75 x 1.5 x 5" Flanges) 1.378 lbs 16 Pcs.

2 x 4's x 16.375" 3 Pcs 5.956 lbs. 44.76 %

4 x 4's x 16.375" 2 Pcs 7.352 lbs. 55.24 %

5.0343 kg

Est. Dry Burn Rate (Kg/Hr.) $\frac{13.308 - (13.308 \times .16602)}{2.2046} \times \frac{60}{245}$ = 1.233 Est. Dry Burn Rate (Kg/Hr)

Est EPA Heat Output (HO_E) (Avg BTU's/Hr) (19,140) X $\frac{63}{100}$ x 1.233 = 14,866 Est Heat Output (HO_E) BTU's/Hr

Comments:

Stove Operating Data
Woodstove Test Data Sheet #9
Cold Start

Fire Started: 08:08

Unit: Kuma Ashwood
Run: EPA 3
Date: 2/18/09
Technician(s): ATM JRP RDG
Data Sheet #9 - Rev 1/98-Pg.1

Warm up and Preburn: Primary Air: Wide open from ignition until the start of preburn when the primary air control(s) was (were) adjusted to the run setting of 2.561 thr rds .553". At the run setting until the start of the test.

Secondary Air: No Controls. Naturally drafted

Secondary Burn/[redacted] Bypass: N/A

Charcoal Bed Preparation: Broke up, raked and leveled the coal bed prior to the addition of each warm up/pre burn fuel charge. Starting 1:30 before the start of the test, broke up, raked and leveled the coal bed. In stove for 32 seconds.

Test: Door wide open during loading 0 min 58 sec, then Closed.

Primary Air: Wide open from the start of the test (0:00) until 4:45.
Adjusted to the run setting of .553" open between 4:45 and 5:00.
At the run setting of .553" open at 5:00 into the run.

Secondary Air:
No Controls. Naturally drafted.

Secondary Burn/[redacted] Bypass: N/A

Fan: OFF. Fan Confirmation Test

Test Run Anomalies: None, Great Run.

Unit Kuma Ashwood
Run # EPA 3
Date 2/18/109
Technician ATM
Page 1 of
WST7-Form2-A, Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-1

Wood Data: Kindling: A mix of the below grades

	Size	Mill	Grade	Species
Pre Burn	2X4	Forest Grove	#2, Std & Btr	D. Fir, Sfc Grn
Test Fuel	2X4	Forest Grove	#2, Std & Btr	D. Fir, Sfc. Grn
	4X4	Forest Grove	No. 1	D. Fir, Sfc. Grn

All grades WCLB Rules unless otherwise noted.

Warm up Information:

1st Warm up/Pre Burn Fuel charge (10.360 lbs) added at 0824.
2nd Warm up/Pre Burn Fuel charge (12.574 lbs) added at 0917.
3rd Warm up/Pre Burn Fuel charge (10.676 lbs) added at 1023.
4th Warm up/Pre Burn Fuel charge (____ lbs) added at ____.
5th Warm up/Pre Burn Fuel charge (____ lbs) added at ____.
6th Warm up/Pre Burn Fuel charge (____ lbs) added at ____.
7th Warm up/Pre Burn Fuel charge (____ lbs) added at ____.
8th Warm up/Pre Burn Fuel charge (____ lbs) added at ____.

1st Rick 4-12", 4-16" 2X4's 3rd Rick 4-12", 3-16" 2X4's
2nd Rick 8-16" 2X4's

The coals were scooped out of the stove immediately prior to adding the 3rd pre burn/warm up fuel charge. The stove lost 0.1 lbs. 2.0 lbs. of coals were put back in the stove after the scoop.

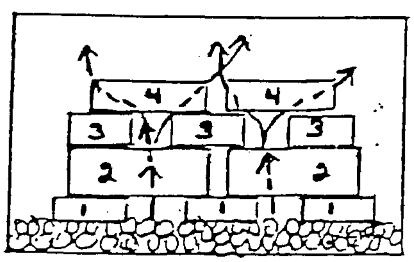
All pre burn/warm up fuel pieces were either 12 or 16 inches long. All preburn pieces/fuel charges were "ricked" in the stove. The pieces in the bottom layer in each rick contained 2 pcs that were 12 or 16 inches long and were loaded flat and perpendicular to the door. The pieces in the second layer in each rick were loaded on their side (edge) approximately parallel to the door and contained 3 or 4 pcs 16 inches long. The third layer (and fourth layer if present) was loaded flat, perpendicular to the door and contained 2 pcs 12 or 16 inches long. The majority of the pieces in each rick were in the second layer which had an approximate 0.5-1.0" space between pieces. (The loading directions indicate the direction of the longest dimension on each piece relative to the loading door opening.) Each pre burn/warm up fuel charge normally weighs within the weight range allowed for the actual test fuel charge

Unit Kuma Ashwood
Run # EPA 3.
Date 2/ 18 /99
Technician ATM
Page 2 of
WST7-Form2-A, Rev 6/90

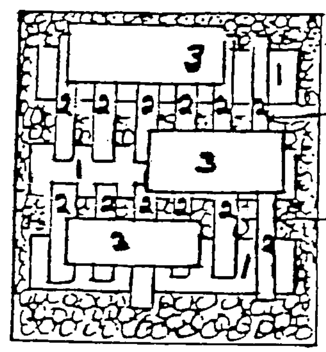
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-2

Warm up Information (cont.):

Each warm up/preburn fuel charge was ricked in exactly (as much as possible) the same manner and the weight of each rick was usually within the allowable weight range for the test fuel charge. The physical arrangement and alignment of each rick was designed to accomplish three (3) things: (1)The bottom layer was nestled firmly into the coal bed and was as close to being level with the bottom of the stove as possible, thus providing a stable loading platform for the rest of the rick, keeping it in a ricked state (as opposed to a col- lapsed or fallen down state) untill the rick reached the charcoal stage and sags or collapses of its own accord. (2) It enhances the flow of primary air through the ricked preburn fuel charge, for the primary air would flow through the spaces between the pieces in the first layer and then up through the spaces between the pieces in the second, third and, if present, fourth layers. (3) It maximized, as much as possible, the surface to volume ratio of each preburn fuel charge, thereby allowing the fire immediate access to as much wood surface as possible and, thereby, insuring uniform charcoalization. All three of these enhance combustion and so get the stove as hot as possible during the warm up period, therby maximizing the amount of heat (BTU's) stored in the stove. The actual preburn was not started until the stove surface temperatures had maximized and stabilized, thus indicating that the amount of heat stored in the stove had peaked. For this stove, the thermal storage was monitored using the Stove Top T/C surface temperature(s) and the peak value(s) obtained were 1088 °F. 991 1088



Front View



Top View

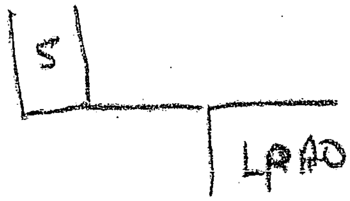
The arrows indicate the direction of the air flow through the rick.

The primary air was adjusted to the run setting of 0.553" open 4.7 lbs above the upper charcoal bed weight.

Unit Kuma Ashwood
Run # EPA 3
Date 2/18/09
Technician ATM
Page 3 of
WST5-Form2-Rev11/89

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-3

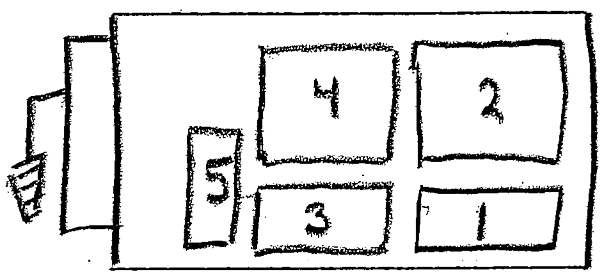
Additional Comments: Test Start Sequence: (1) Adjusted Primary Air Control to Wide Open. (2) Opened Door (3) Loaded fuel (4) cleared coals away from in front of the LPAO (5) Closed Door



TOTAL ElapsED Time: 0:58
Photo @ 1:30

Test Fuel Charge Loading Information:

Test Fuel Charge and Loading Sequence Diagram



SIDE of stove view

4 X 4's: 2,4

2 X 4's: 1,3 & 5

Loading Sequence: 1,2,3,4 & 5 last

Driest Pcs in Load 5,3

Loaded the test fuel charge on an essentially level, Medium sized, average to hot coal bed (in appearance, color and temperature for a Med Low (1.0-1.25) burn rate. Load: 0:58 Ignition: 0:50 on Left end of 5

1:00 VC ↑ baffle
1:30 Secondaries igniting
2:30 Great Start
4:45-5:00 PAC adjusted to the run setting.
5:00 Maintained a hot pocket of coals under and behind pc 5 with a VC up to the baffle, + Secondaries full width of 5. 11.3/.51 (%CO2/%CO)
5:46 Secondaries centering (decreasing)
7:50 " increasing

Unit: Kuma Ashwood
Run: EPA 3
Date: 2/18/09
Technician: ATM JRP PDG

FUEL MOISTURE
WOODSTOVE TEST DATA SHEET #10

WST1-Form7-Rev11/89

5 kg. = 11.024 lbs. 1 kg. = 2.204 lbs

Room Temperature: 61.5 °F

Correction Factor: +1.0

NOTE: Record readings to the nearest 0.5% moisture
Uncor Values are corrected for temperature: Yes ✓ No
Time Test Fuel Moisture Readings taken at: 839
Calibration Checks: X — Y — 12.0 11.6 22.0 22.1

Pc #	Dimen	Use	Top Uncor	Top Cor	Bottom Uncor	Bottom Cor	Side Uncor	Side Cor	Piece Avg Corrected
1	3 pcs	K	9	9.5	9	9.5	8.5	8.95	9.317
2									
3									
4	2x4-8'	P	18.5	19.8	22.5	22.0	18	19.2	20.333
5			18	19.2	22	23.7	21	22.6	21.833
6			20.5	21.4	21.5	23.1	22	23.7	22.733
7			22	23.7	19.5	20.9	20	21.4	22.000
8			19.5	20.9	20	21.4	20	21.4	21.233
9									108.132
10									
11									
2.040 12	2x4-16 3/8"	T	20	21.4	19.5	20.9	19.5	20.9	21.067
1.522 13			18	19.2	18	19.2	18	19.2	19.200
14			18	19.2	18	19.2	18	19.2	19.200
15									
3.534 16	4x4-16 3/8"	T	19	20.3	18.5	19.8	20.5	22.0	20.700
3.484 17			18	19.2	17.5	18.6	19.0	20.3	19.367
18									99.834
19									
1.378 20	Spacers	T	18	19.2	19	20.3	19	20.3	19.933

OUT Spacers

	Kindling	Pretest Fuel	Test Load
% Moisture - Dry Basis:	9.317 %	21.6264 %	19.9068 %
% Moisture - Wet Basis:	8.523 %	17.781 %	16.602 %

13.308 4x4 7.352

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

5.034

1 10.360
2 12.574
3 10.676

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

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

Unit: Kuma Ashwood
Run#: EPA 3
Date: 2/18/09
Technician: A.T Myren

WOOD DENSITY DETERMINATION
WOODSTOVE TEST DATA SHEET #11

WST2-form11-Rev 6/90

Wood Piece: Nominal Dimensions: 2x4 3.5" x 3.5" x 1.5"

Depth (D): 3.795 cm

Width (W): 8.765 cm

Length (L): 8.780 cm, 8.745 cm, 8.769 cm, 8.775 cm

Length $\bar{X}$ = 8.76725 cm

Volume: 291.627 cm^3 (D X W X L)

MOISTURE: Room Temperature: 61.5 °F Correction Factor: +1.0

Uncorrected Meter Readings Corrected for temperature: Yes ✓ No ___

NOTE: Record moisture meter readings to the nearest 0.5%

	Uncor	Cor
Top:	19	20.3 %
Bottom:	19	20.3 %
Side:	18	19.2 %
$\bar{X}$:		19.933 %

Avg % Moisture (Dry) 19.933 %

Aug % Moisture (Wet) 16.620 %

Scale: Leveled In ✓ Out ✓

Zeroed: In ✓ Out ✓

Wet Weight: 126.7 g Dry Weight: 109.3 g

% Moisture Dried Basis: 13.733 %
[1 - (Dry Wt ÷ Wet Wt)] X 100

	Date	Time	Temp
Into Dryer	2/18/09	1517	190 °F
Out of Dryer	3/2/09	0915	192 °F

(Minimum Time in Dryer: 24 hrs.) Minimum Dryer Temp 100°C (212°F)

Density = 109.3 g (dry wt) ÷ 291.627 cm^3 (volume) = 0.3748 g/cm^3

Pellet Fuel Moisture Content Determination

Tare Beaker Wt. ______ g

Wet Wt: ______ g - ______ g = ______ g
Gross Wet Wt. Tare Beaker Wt. Net Wet Wt.

Dry Wt: ______ g - ______ g = ______ g
Gross Dry Wt. Tare Beaker Wt. Net Dry Wt.

% Moisture Dried Basis: ______ %
[1 - (Net Dry Wt ÷ Net Wet Wt.)] X 100

7 + I '

Pre Burn Start WT.
4.7 lbs. / 771.8 lbs.
Test Start wt. Range
767.1 - 766.5 lbs.

PRE BURN DATA
RECORD SHEET #13
WST2-Form16

BARO. PRESSURE 28.51

Unit: Kuma Ashwood
Run: EPA 3
Page: 1 of 1
Date: 2.18.09
Technician(s): ATM JRP PDG

Hot Box On ✓

Minute	Time	Scale Weight	Burn Rate	T/C#-3 Stack	4 Stove Top	5 Left Side	6 Back	7 Right Side	8 Bottom	9 Firebox	10 2nd Burn	17	11 Room Temp	Static	Comments
0	1040	771.8	O	625	1052	630	511	621	416	979	1394	1209	76	-077	RAKE FWD @30mm (45m OR FLAMED)
5	45	771.0	.18	471	965	629	504	620	415	956	1377	1266	77	-067	Primary Air Set at: Thrd. rod 2.561" .553" PA
10	50	770.3	.17	425	940	625	486	617	415	977	1385	1261	76	-063	Secondary Air Set at fixed
15	55	769.6	.17	411	918	624	475	615	414	1002	1401	1496	76	-062	Fan: OFF - ECT
20	1100	768.9	.17	402	912	629	464	615	412	1024	1426	1506	76	-062	Tunnel on at: 1105
25	05	768.3	.16	389	906	633	456	614	409	1038	1401	1485	77	-061	Buckets Iced ✓
30	10	767.9	.14	362	876	631	460	615	406	996	1366	1309	77	-056	Analyzers Spanned
35	15	767.7	.12	331	810	623	478	614	403	994	1346	1251	77	-051	Pumps turned on at: 1144
40	20	767.5	.12	311	745	614	495	612	400	960	1321	1272	77	-049	585.6 ΔT ΔΔT
45*	25	767.3	.12	295	699	604	500	606	398	950	1199	1178	77	-046	573.2 -12.4
50	30	767.2	.1	296	647	593	489	594	396	933	1162	1018	76	-046	Raked Rod Check WB/DB: 561.4 -11.8
55	35	767.1	.1	270	612	573	473	576	394	881	995	920	76	-042	543.8 -17.6
		-												-	525.6 -18.2
60	1140	767.0	.1	263	587	556	454	561	394	850	964	889	76	-041	Probe In Tunnel ✓
65	45	766.9	.1	255	563	539	440	543	392	826	949	870	76	-040	Tunnel ΔP ✓ 510.4 -15
70	50	766.8	.1	251	542	524	422	529	391	806	945	862	75	-039	495.4 -15
75	55	766.7	.1	246	526	511	405	514	389	791	940	831	76	-038	481.6 -13.8
80															469.0 -12.6
85															
90															

* Raked Rod. @46mm.

455.-466.5

Myren Consulting Inc Data Sheet P1 of 2 Unit Kuma [illegible] Date 2 / 10 / 04 Run EPA 5
Test End Wt. 766.7 ΔT 469.0 Barometric Pressure 28.51 "hg Gas Flows @ 1.5" Technician(s) ATW JF PDG

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
0	1155	780.0	13.3	0	.293	4.67		15.61	.124	1.24	3.8	FanOff FCT				246	-.036
05	1200	779.3	12.6	.17	.342	13.51		12.05	.069	.69	12.3	W-L Bal				365	-.063
10	05	778.8	12.1	.15	.401	9.96		10.40	.100	1.08	9.2	L-m				342	-.052
15	10	778.3	11.6	.15	.436	10.83		9.55	.105	1.05	10.3	L (balance 15155)				311	-.051
20	15	777.7	11.0	.16	.582	14.44		6.00	.092	.92	15.7	wisps				326	-.053
25	20	777.0	10.3	.17	.620	15.38		5.18	.069	.69	22.3	"				339	-.054
30	25	776.3	9.6	.17	.678	16.81		5.83	.089	.89	16.8	wispy				353	-.056
35	30	775.7	9.0	.16	.716	17.75		2.69	.092	.92	19.3	clear				363	-.057
40	35	775.1	8.4	.16	.722	17.90		2.54	.063	.63	28.4	" mid sec. of 5 fell to bottom				366	-.057
45	40	774.5	7.8	.16	.688	17.06		3.53	.063	.63	27.1	"				362	-.056
50	45	774.0	7.3	.15	.650	16.12		4.53	.051	.51	31.6	"				365	-.054
55	50	773.5	6.8	.15	.584	14.49		6.19	.045	.45	32.2	"				342	-.053
Tot																4092	.644

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2^{nd} burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 #19	Tube 3 #20
0	1155	526	511	405	514	369	791	940	76	94	213	32	72	58	831			
05	1200	542	497	363	500	365	706	1331	76	123	216	33	76	36	1064			
10	05	607	500	378	501	360	675	1330	76	105	231	33	79	36	1164			
15	10	603	491	370	491	376	675	1339	76	100	229	33	79	36	1212			
20	15	632	486	354	486	372	691	1352	76	101	223	34	79	36	1230			
25	20	673	486	343	488	367	723	1361	76	101	221	34	79	36	1254			
30	25	729	490	333	491	360	768	1394	75	102	222	35	79	36	1242			
35	30	774	500	324	501	353	816	1395	76	102	226	35	79	36	1238			
40	35	799	511	318	509	347	850	1397	76	102	227	36	79	36	1242			
45	40	803	525	316	518	341	879	1383	76	102	225	36	79	36	1297			
50	45	794	539	313	524	336	903	1363	76	101	222	37	80	36	1226			
55	50	773	551	314	526	332	895	1314	77	100	216	37	80	36	1193			
Tot		8255	6089	4151	6057	4340	9374	15899	912									

Myren Consulting Inc Data Sheet P2 of 2 Unit Kuma Ashwood 2000 Date 2 / 10 / 04 Run EPA 5
Test Er Wt. 76.17 ΔT 469.0 Barometric Pressure 28.5 "hg Gas Flows @ 1.5" Technician(s) ATM JRF DDG

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
60	1255	773.1	6.4	.4	.530	13.15		7.55	.040	.40	32.9	Clear hole thru 3				329	-.051
65	1300	772.7	6.0	.4	.529	13.13		7.52	.050	.50	26.3	"				325	-.050
70	05	772.2	5.5	.5	.625	15.50		5.08	.064	.64	24.2	" 3.5 thru 1 glowing				330	-.052
75	10	771.7	5.0	.5	.641	15.89		4.68	.066	.66	24.1	"				334	-.052
80	15	771.2	4.5	.5	.624	15.47		5.09	.068	.68	22.8	"				332	-.051
85	20	770.8	4.1	.4	.598	14.83		5.72	.069	.69	21.5	W-L				325	-.050
90	25	770.3	3.6	.5	.637	15.80		4.67	.066	.66	18.4	wispy				328	-.051
95	30	769.9	3.2	.4	.646	16.02		4.56	.064	.64	25.0	W-L				331	-.052
100	35	769.5	2.8	.4	.599	14.86		5.82	.044	.44	28.8	clear				324	-.050
105	40	769.3	2.6	.2	.444	11.03		9.33	.100	1.00	10.2	wispy				299	-.047
110	45	769.1	2.4	.2	.435	10.80		9.47	.126	1.26	8.8	light OOB				267	-.044
115	50	768.9	2.2	.2	.390	9.69		10.53	.136	1.36	7.1	clear				274	-.042
Tot																3818	.592

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2nd burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 #19	Tube 3 #20
60	1255	743	558	313	529	329	886	1237	77	99	215	37	79	38	1145			
65	1300	725	554	313	527	326	917	1250	77	99	214	37	79	38	1209			
70	05	727	550	316	527	324	957	1322	77	99	219	37	79	38	1242			
-75	10	736	552	327	530	321	970	1307	77	99	224	37	79	38	1260			
80	15	739	558	338	533	319	966	1279	78	99	226	37	79	38	1259			
85	20	732	565	345	536	317	967	1276	77	98	224	37	79	38	1272			
90	25	730	565	352	538	316	991	1318	77	98	221	37	79	38	1278			
95	30	742	568	359	543	315	994	1336	77	99	220	37	80	38	1256			
100	35	737	569	372	546	315	961	1284	77	98	219	37	79	38	1219			
105	40	704	565	396	546	315	921	1168	77	96	217	36	79	38	1180			
110	45	670	561	408	543	315	911	1126	77	95	217	36	79	38	1205			
115	50	655	552	416	537	315	899	1035	77	94	219	36	79	38	1102			
Tot		8640	6717	4257	6437	3827	11340	14938	925									

Myren Consulting Inc Data Sheet P3 of 5 Unit Kuma Ashwood Date 2 / 18 / 09 Run FPA3

Test End 7661.7 ΔT 469.0 Barometric Pressure 28.5 "hg Gas Flows @ 1.5" Technician(s) ATM JRF PDG

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
120	1355	768.8	2.1	.1	.358	8.90		11.44	.111	1.11	8.0	clear				262	-.041
125	1400	768.7	2.0	.1	.363	9.02		11.36	.104	1.04	8.7	"				253	-.039
130	05	768.6	1.9	.1	.354	8.90		11.49	.121	1.21	7.3	"				247	-.038
135	10	768.5	1.8	.1	.337	8.38		11.85	.134	1.34	6.3	"				241	-.038
140	15	768.4	1.7	.1	.330	8.21		11.99	.140	1.40	5.9	"				236	-.036
145	20	768.3	1.6	.1	.321	7.99		12.15	.152	1.52	5.3	"				233	-.035
150	25	768.2	1.5	.1	.311	7.74		12.35	.163	1.63	4.7					229	-.034
155	30	768.1	1.4	.1	.305	7.59		12.45	.171	1.71	4.4					226	-.034
160	35	768.0	1.3	.1	.297	7.39		12.65	.176	1.76	4.3					224	-.033
165	40	767.9	1.2	.1	.284	7.07		12.89	.187	1.87	3.8					221	-.032
170	45	767.9	1.2	0	.284	7.07		12.86	.193	1.93	3.7					217	-.031
175	50	767.8	1.1	.1	.281	7.00		12.93	.195	1.95	3.6					211	-.030
Tot																2802	.421

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2nd burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 #19	Tube 3 #20
120	1355	604	542	431	527	314	885	1023	76	93	222	36	70	38	1067			
125	1400	577	535	440	519	315	889	1012	76	92	225	36	76	38	1038			
130	05	558	529	440	513	315	887	991	76	91	225	36	76	38	1013			
135	10	535	522	436	504	315	876	981	75	91	223	36	76	38	985			
140	15	523	517	433	500	316	850	965	75	91	223	36	78	38	972			
145	20	508	511	428	494	316	829	944	75	90	222	36	78	38	956			
150	25	495	505	424	480	316	821	931	76	90	222	36	78	38	941		ΔT	ΔT
155	30	486	499	421	481	316	807	910	76	91	222	36	78	38	926		440.6	-28.4
160	35	475	493	418	474	317	794	896	76	91	221	36	79	38	907			
165	40	465	488	411	466	317	781	864	76	91	221	36	79	38	891		429.4	-39.6
170	45	455	482	405	463	317	768	851	77	92	222	36	80	38	876			
175	50	445	477	400	456	314	757	841	76	91	222	35	79	37	865		418.4	-50.6
Tot		6126	6109	5087	5885	3788	9956	11189	910									

11209

Myren C[illegible]sulting Inc Data Sheet P4 of 5 Unit Kuma Ashwood Date 2 / 18 / 09 Run EPA 3
Test En[illegible]t. 766.7 ΔT 469.10 Barometric Pressure 28.5 "hg Gas Flows @ 1.5" Technician(s) ATM JRP DG

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
180	1455	767.7	1.0	.1	.1282	7.02		12.91	.193	1.93	3.6	clear				213	-.030
185	1500	767.6	.9	.1	.279	6.95		12.95	.200	2.00	3.5					210	-.029
190	05	767.5	.8	.1	.282	7.02		12.86	.203	2.03	3.5					209	-.028
195	10	767.4	.7	.1	.274	6.83		13.06	.203	2.03	3.4					206	-.028
200	15	767.4	.7	0	.275	6.85		12.97	.216	2.16	3.2					207	-.028
205	20	767.3	.6	.1	.271	6.75		13.07	.215	2.15	3.1					205	-.028
210	25	767.2	.5	.1	.263	6.55		13.30	.209	2.09	3.1					203	-.028
215	30	767.1	.4	.1	.269	6.70		13.29	.182	1.82	3.7					201	-.027
220	35	767.0	.3	.1	.261	6.50		13.49	.181	1.81	3.6					200	-.027
225	40	767.0	.3	0	.252	6.28		13.69	.185	1.85	3.4					197	-.027
230	45	766.9	.2	.1	.246	6.16		13.64	.196	1.96	3.2					198	-.027
235	50	766.8	.1	.1	.242	6.03		13.86	.202	2.02	3.0					196	-.026
Tot																2447	.333

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2^{nd} burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 ~~#19~~ ΔT	Tube 3 #20 ΔT
180	1455	442	476	399	454	316	750	833	77	92	224	36	60	38	854		417.4	-51.6
185	1500	435	472	396	447	316	742	826	78	92	225	36	61	38	847		413.2	-55.8
190	05	430	469	394	444	315	736	821	77	92	224	36	61	38	846		410.4	-58.6
195	10	425	465	393	436	314	729	815	77	91	223	36	61	38	843			
200	15	421	463	392	436	313	723	809	77	91	221	36	61	38	838		405.0	-64.0
205	20	417	459	391	430	312	715	796	77	91	220	37	61	36	831		401.8	-67.2
210	25	413	456	390	424	311	707	790	77	91	221	36	61	36	830			
215	30	409	453	390	423	310	695	785	77	92	221	36	61	38	824			
220	35	404	448	391	420	309	684	779	76	92	222	36	62	38	820			
225	40	399	443	369	414	308	676	772	77	91	221	35	61	37	814		390.6	-78.4
230	45	397	439	369	412	307	668	765	76	92	223	36	62	36	808			
235	50	394	435	388	409	306	660	758	76	92	223	36	62	36	801		386.4	-82.6
Tot		4986	5478	4702	5151	3737	8485	9540	928									

Myren[illegible]sulting Inc Data Sheet P5 of 5 Unit Kuma A [illegible]wood Date 2 / 1 / 09 Run [illegible]PA
Test End Wt 766.7 ΔT 469.0 Barometric Pressure 28.515 "hg Gas Flows @ 1.5" Technician(s) ATM JRK PDG

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
240	1555	766.8	.1	0	.241	6.01		13.88	.202	2.02	3.0					196	-.026
245	1600	766.7	0	.1	.241	6.01		13.96	.185	1.85	3.2					195	-.025
250																391	.051
255													Total			13550	2.041
260													AVG	÷	50	271	.041
265																	
270																	
275																	
280																	
285																	
290																	
295																	
Tot																	

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2nd burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Tube 1 #17	Tube 2 #18	Tube 3 #19	H_2O H box #20
240	1555	392	431	386	407	305	653	751	76	93	223	36	62	38	795		ΔT	ΔΔT
245	1600	389	426	387	403	304	649	747	79	93	223	36	63	38	786		382.2	-86.8
250		781	859	775	810	609	1302	1498	157									
255		28788	25243	18972	24334	16,301	40457	~~53073~~	3832	Total								
260		576	505	379	487	326	809	~~1061~~	77	AVG	÷50							
265								53093							Delta	T		
270								1062							Start	469.0		
275															Stop	382.2		
280															ΔΔT	-86.8		
285																		
290																		
295																		
Tot																		

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-1

Site: Myren Consulting, Colville [redacted], WA Date: 2/18/09 Analyte: CO_2

Source: Kuma Ashwood Run #: EPA 3

Zero Cyl #: TC 3AAM154 Conc. 00.0 % CO_2 Cyl Press: 1510 psi

Certified by: Oxarc Date: 11/12/07

Span Cyl #: AS 90457 Conc. 12.5 % CO_2 Cyl Press: 1490 psi

Certified by: Matheson Tri Gas Date: 2/2/09

Analyzer: Make: Horiba Model: PIR-2000 SN: 607024

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

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 25.0% CO_2

EPA Control Limits = $\pm$ 2.5% of 25.0% CO_2 = $\pm$ 0.625% CO_2

Pre Run Audit: By: A.T. Myren Time: 1105 Temp: 75 °F

Audit Results

Point #	Expected Response Meter	Expected Response DVM	Expected Response %	Actual Response Meter	Actual Response DVM	Actual Response %	$\pm$ Conc. Difference	Δ %
Zero	00.0	.000	00.0	00.0	.000	.05453	+0.05453	+0.22
Span	50.0	.500	12.5	49.75	.499	12.3858	-0.1142	-0.91

Comments:

Post Run Audit: By: A.T. Myren Time: 1656 Temp: 77 °F

Audit Results

Point #	Expected Response Meter	Expected Response DVM	Expected Response %	Actual Response Meter	Actual Response DVM	Actual Response %	$\pm$ Conc Difference	Δ %
Zero	00.0	.000	00.0	00.0	.000	.05453	+0.05453	+0.22
Span	50.0	.500	12.5	50.5	.506	12.5587	+0.0587	+0.46

Comments:

$\pm$ Conc. Difference = Act % - Exp (Std) %

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

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

WST6-Form10 Rev 5/96

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-3

Site: Myren Consulting, ~~Woodinville~~ Colville, WA Date: 2/18/09 Analyte: CO

Source: Kuma Ashwood Run #: EPA 3

Zero Cyl #: TC3AAM 154 Conc. 00.0 % CO Cyl Press: 1510 psi

Certified by: Oxarc Date: 11/12/07

Span Cyl #: AS 90457 Conc. 2.00% CO Cyl Press: 1490 psi

Certified by: Matheson Tri Gas Date: 2/2/09

Analyzer: Make: [redacted] HORIBA Model: [redacted] MEXA 311GE SN: [redacted] GE-30075

Range: 0 - 10.0% CO Analyzer Output: 0 - ~~100~~ 1.0 V

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter: ____

EPA Span Value = 5.0% CO
EPA Control Limits = +2.5% of 5.0% CO = + 0.125% CO ✓

Pre Run Audit: By: A. T. Myren Time: 1105 Temp: 75 °F

Audit Results

Point #	Expected Response Meter	Expected Response DVM	Expected Response %	Actual Response Meter	Actual Response DVM	Actual Response %	± Conc. Difference	Δ %
Zero	00.0	00.0	00.0	0.00	.000	-.00443	-0.00443	-0.04
Span	2.00	.200	2.00	2.00	.200	2.00595	+0.00595	+0.30

Comments:

Post Run Audit: By: A. T. Myren Time: 1656 Temp.: 77 °F

Audit Results

Point #	Expected Response Meter	Expected Response DVM	Expected Response %	Actual Response Meter	Actual Response DVM	Actual Response %	± Conc. Difference	Δ %
Zero	00.0	00.0	00.0	0.00	.000	-.00443	-0.00443	-0.04
Span	2.00	.200	2.00	1.99	.199	1.9959	-0.0041	-0.21

Comments:

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

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

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

Unit Kuma Ashwood
Run EPA 3
Date 2/18/09
Technicians ATM JRP PDG
WST5-Form3-Rev11/89

QUALITY CHECKS
WOODSTOVE DATA SHEET #16

Ambient = Tr: _____ °F T/C#30: _____ °F

Thermocouple Check (at ambient): T/C#1: —— °F; T/C#2: 66.2 °F;

T/C #3: 63.7 °F;	T/C #4: 63.3 °F;	T/C #5: 62.4 °F;
T/C #6: 63.0 °F;	T/C #7: 62.8 °F;	T/C #8: 68.7 °F;
T/C #9: 74.8 °F;	T/C #10: 60.7 °F;	T/C #11: 61.5 °F;
T/C #12: 63.7 °F;	T/C #13: 63.4 °F;	T/C #14: 59.2 °F;
T/C #15: 62.9 °F;	T/C #16: 53.5 °F;	T/C #17: 74.2 °F;
T/C #18: _____ °F;	T/C #19: _____ °F;	T/C #20: _____ °F;
T/C #21: _____ °F;	T/C #22: _____ °F;	T/C #23: _____ °F;
T/C #24: _____ °F;	T/C #25: _____ °F;	T/C #26: _____ °F;

Comments: _____

Thermocouple Readout: Pretest Zero/Span Check and Calibration:

			% Difference
Zero (0°F): 0.2 °F	Adj to: — °F	Post Test Check Zero (0°F): 0.6 °F	+0.13
Span (2000°F): 2000.3 °F	Adj to: — °F	Span (2000°F): 2001.6 °F	+0.07

(Allowable % Difference = 1.5%. Use formulas on Woodstove Data Sheet #15 to calculate % Difference) In Degrees Absolute.

Thermocouple Readout Pretest Linearity Check

0°F = 0.2 °F;	200°F = 202.1 °F;	400°F = 399.4 °F;
600°F = 601.6 °F;	800°F = 801.8 °F;	1000°F = 1001.0 °F;
1200°F = 1198.8 °F;	1400°F = 1399.6 °F;	1600°F = 1600.2 °F
1800°F = 1800.3 °F;	2000°F = 2000.3 °F	

Combustion Gas (CO_2, O_2, CO) Train Leak Check: Pre ✓ PDG Post ✓ PDG

Draft (Static) Guage Zero Check: Pre ~~ATM~~ Post ✓ PDG

Scale Check Pre (Wt, #'s): 770.4 - 765.4 = 5.0 lbs / 5.0 lbs = ok ATM

Post (Wt, #'s): 770.7 - 765.7 = 5.0 lbs / 5.0 lbs = ok PDG

Stack cleaned prior to the run: Yes _____ No ✓

Tunnel cleaned prior to the run: Yes _____ No ✓

EP. LOW

MYREN CONSULTING CERTIFICATION TEST DATA

DILUTION TUNNEL CALCULATIONS

1\25\09, Md=28.56, Bws=4% 6" Tunnel

		RUN TIME (min)	PITOT DELTAP (- INCH H20)	TNL TEMP (°F)	GAS METER RDG (ft3)	GAS METER TEMP (°F)	GAS METER DELTA H (in.H2O)	TUNNEL VELOCITY (ft/min)	PROP RATE (%)	dDGM vol std (ft3)	Tunnel Static (- Inch H2O)	SQUARE ROOT DELTA P	DRY GAS METER RDG (m3)
File Name:	EPA 5												
Manufacturer:	KUMA												
Model Number:	ASHWOOD												
Lab Name:	MYREN												
Test Date:	2\20\09	0	0.041	96	457.4020	70	0.900	849.23			0.154	0.2025	
Run Number:	EPA 5	10	0.040	103	462.6680	73	0.900	844.07	104.1	5.076	0.151	0.2000	
Meter Box Y Factor:	1.0177	20	0.040	97	467.9480	76	0.900	839.57	102.7	5.061	0.152	0.2000	
Barometric pressure (in):	28.551	30	0.039	98	473.1950	79	0.900	829.75	102.3	5.001	0.152	0.1975	
Gas meter temp (ave):	**89**	40	0.040	102	478.4560	82	0.900	843.32	100.5	4.987	0.151	0.2000	
delta H(avg):	**0.900**	50	0.040	101	483.7080	85	0.900	842.57	99.1	4.951	0.150	0.2000	
Gas meter initial reading:	457.4020	60	0.040	101	488.9600	87	0.900	842.57	98.4	4.933	0.150	0.2000	
Gas meter final reading:	602.7820	70	0.040	102	494.2340	88	0.900	843.32	98.5	4.944	0.150	0.2000	
Front catch (acetone) mg:	5.8	80	0.040	101	499.5030	89	0.900	842.57	98.0	4.931	0.150	0.2000	
first filter catch (mg):	66.7	90	0.040	100	504.7830	90	0.900	841.82	97.8	4.932	0.150	0.2000	
second filter catch (mg):	0.6	100	0.040	98	510.0520	90	0.900	840.32	97.4	4.922	0.151	0.2000	
Tunnel Flow (Qsd) (dscfm)	**140.186**	110	0.040	96	515.3330	91	0.900	838.81	97.1	4.924	0.151	0.2000	
Emission Rate(g/hr):	**4.519**	120	0.040	95	520.6160	91	0.900	838.06	97.0	4.926	0.151	0.2000	
Emission Rate(M5H) :	**6.365**	130	0.039	95	525.9140	91	0.900	827.51	98.5	4.940	0.151	0.1975	
Avg. of Delta P Sq. Roots:	**0.2000**	140	0.040	94	531.2110	92	0.900	837.30	96.8	4.930	0.151	0.2000	
Vs (Avg.)(ft/min):	**822.400**	150	0.040	93	536.5000	92	0.900	836.54	96.6	4.922	0.150	0.2000	
Tunnel Avg. Temperature (F):	**96.793**	160	0.040	93	541.8020	92	0.900	836.54	96.9	4.935	0.151	0.2000	
Test time(min):	275	170	0.040	92	547.1140	92	0.900	835.79	96.9	4.944	0.152	0.2000	
Fuel Load(lb. wet):	13.332	180	0.040	94	552.4120	92	0.900	837.30	96.9	4.931	0.151	0.2000	
Wood moisture(%wet):	16.449	190	0.039	95	557.7130	93	0.900	827.51	97.9	4.925	0.151	0.1975	
Burn rate(dry kg/hr):	**1.102**	200	0.040	95	563.0180	93	0.900	838.06	96.7	4.928	0.151	0.2000	
Sample Volume (dscf)	**136.052**	210	0.040	95	568.3250	93	0.900	838.06	96.8	4.930	0.152	0.2000	
Avg. Tunnel Static (-inch H2O):	**0.1510**	220	0.040	96	573.6280	94	0.900	838.81	96.4	4.918	0.152	0.2000	
Room Blank Catch (mg/dscf):	0	230	0.039	98	578.9160	94	0.900	829.75	97.6	4.904	0.151	0.1975	
Emission Factor (g/kg):	**4.0995**	240	0.040	97	584.2140	94	0.900	839.56	96.4	4.913	0.151	0.2000	
Pitot Correction Factor:	0.97975	250	0.040	97	589.5280	95	0.900	839.56	96.4	4.919	0.151	0.2000	
front filter number	714	260	0.039	95	594.8420	94	0.900	827.51	97.8	4.928	0.151	0.1975	
back filter number	713	270	0.039	94	600.1330	94	0.900	826.77	97.3	4.907	0.150	0.1975	
Beaker Number:	25	275	0.040	94	602.7820	94	0.900	837.30	96.2	2.457	0.151	0.2000	
PRELIMINARY RESULTS					0.0000			0.00	0.0	0.000		0.0000	
FINAL RESULTS:	AUDITED	300			0.0000			0.00	0.0	0.000		0.0000	
DATA SUMMARY		310			0.0000			0.00	0.0	0.000		0.0000	
MODEL:	ASHWOOD	320			0.0000			0.00	0.0	0.000		0.0000	
RUN:	EPA 5	330			0.0000			0.00	0.0	0.000		0.0000	
DATE:	2\20\09	340			0.0000			0.00	0.0	0.000		0.0000	
DBR:	1.102	350			0.0000			0.00	0.0	0.000		0.0000	
EMISSION RATE (g/hr)(M5H)	6.3647	360			0.0000			0.00	0.0	0.000		0.0000	
EMISSION FACTOR (g/kg):	4.0995	370			0.0000			0.00	0.0	0.000		0.0000	
AVG. % PROPORTIONALITY :	98.033	380			0.0000			0.00	0.0	0.000		0.0000	

METHOD 5G **PARTICULATE SAMPLING DATA** Rev. 2/09

DATE: 2/20/09 PAGE 1 OF 2 UNIT: Kuma Ashwood RUN: EPA 5

METER BOX: 45G-P METER Y: 1.0177 FILTER #'S: (F) 714 (R) 713

.208/.208

PRE TEST LEAK CHECK: .000 CFM @ -15.5 IN HG FILTER SIZE: 110 mm

.846/.846

POST TEST LEAK CHECK: .000 CFM @ -15.2 IN HG PROBE LENGTH 21.0 IN

TIME		METER READING (FT^3)	PITOT		TUNNEL TEMP (°F)	METER TEMP (°F)	GAS METER Δh	VAC (in Hg)
CLOCK	ELAPSED		ΔP	Pg				
1030	00	457.402	.041	-.154	96	70	0.90	0.0
40	10	462.668	.040	-.151	103	73	.90	0
50	20	467.948	.040	-.152	97	76	.90	0
1100	30	473.195	.039	-.152	98	79	.90	0
10	40	478.456	.040	-.151	102	82	.90	0
20	50	483.708	.040	-.150	101	85	.90	0
30	60	488.960	.040	-.150	101	87	.90	0
40	70	494.234	.040	-.150	102	88	.90	0
50	80	499.503	.040	-.150	101	89	.90	0
1200	90	504.783	.040	-.150	100	90	.90	0
10	100	510.052	.040	-.151	98	90	.90	0
20	110	515.333	.040	-.151	96	91	.90	0
30	120	520.616	.040	-.151	95	91	.90	0
40	130	525.914	.039	-.151	95	91	.90	0
50	140	531.211	.040	-.151	94	92	.90	0
1300	150	536.500	.040	-.150	93	92	.90	0
10	160	541.802	.040	-.151	93	92	.90	0
20	170	547.114	.040	-.152	92	92	.90	0
30	180	552.412	.040	-.151	94	92	.90	0
40	190	557.713	.039	-.151	95	93	.90	0

BP

00 28.57
60 28.57
120 28.555
180 28.55
240 28.54 AVG. = 28.551
275 28.52

Pre Test Filter Check Weighing
F .6660
R .6870

End of Test Weight
F .7330 R .6874
.6655 .6866
.0675

METHOD 5G **PARTICULATE SAMPLING DATA** **Rev. 2/09**

DATE: 2/20/09 **PAGE** 2 **OF** 2 **UNIT:** Kuma Ashwood **RUN:** EPA 5

METER BOX: 45G-P **METER Y:** 1.0177 **FILTER #'S: (F)** 714 **(R)** 713

PRE TEST LEAK CHECK: .000 **CFM @** -15.5 **IN HG** **FILTER SIZE:** 110 **mm**

.846/.846

POST TEST LEAK CHECK: .000 **CFM @** -15.2 **IN HG** **PROBE LENGTH** 21.0 **IN**

TIME		METER READING (FT^3)	PITOT		TUNNEL TEMP (°F)	METER TEMP (°F)	GAS METER Δh	VAC (in Hg)
CLOCK	ELAPSED		ΔP	Pg				
1350	200	563.018	.040	-.151	95	93	.90	0
1400	210	568.325	.040	-.152	95	93	.90	0
10	220	573.628	.040	-.152	96	94	.90	0
20	230	578.916	.039	-.151	98	94	.90	0
30	240	584.214	.040	-.151	97	94	.90	0
40	250	589.528	.040	-.151	97	95	.90	0
50	260	594.842	.039	-.151	95	94	.90	0
1500	270	600.133	.039	-.150	94	94	.90	0
75 min 1505	~~80~~ 275	602.782	.040	-.151	94	94	.90	0
	90							
	00							
	10							
	20							
	30							
	40							
	50							
	60							
	70							
	80							
	90							

BP

00 28.57
60 28.57
120 28.555
180 28.55
240 28.54 AVG.= 28.551
275 28.52

Pre Test Filter Check Weighing
F .6660
R .6870

End of Test Weight
F .6655 R .6866

MYREN CONSULTING, INC.

Dilution Tunnel Traverse Data with 8 Traverse Points

Unit: Kuma Ashwood
Run #: EPA 5
Date: 2/ 20 109
Technicians: ATM PDG JRP
Rev 4/2/08

Point	Location	Δp	$\sqrt{\Delta p_{trav}}$	Δp	$\sqrt{\Delta p_{cent}}$	12 T_{trav}	12 T_{cent}	Pg
W-1	0.5"	.038	.1949			101		
2	1.5	.041	.2025			101		
Center	Center			.041	.2025		101	-.160
3	4.5	.040	.2000			101		
4	5.5	.039	.1975			101		
S-1	0.5	.036	.1897			99		
2	1.5	.041	.2025			99		
Center	Center			.041	.2025		99	-.159
3	4.5	.041	.2025			99		
4	5.5	.039	.1975			99		
	Totals		1.5871		.4050	800	200	-.319
	Average		.1984		.2025	100	100	-.1595
	°R = (°F + 460)					560	560	

Ps = BP + (-Pg/13.6) = 28.57 + (-.1595 /13.6) = 28.558

LEAK CHECKS:

Pre Test: Pg Leg: JRP OK Velocity Head Leg: JRP OK

Post Test: Pg Leg: OK Velocity Head Leg: OK

DILUTION TUNNEL GAS VELOCITY & VOLUMETRIC FLOW RATE CALCULATIONS Rev 4/19/08

UNIT: Kuma Ashwood DATE: 2/20/09 RUN #: EPA 5 TECHNICIAN(S): APM JRP PDG

Average Gas Velocity in the Dilution Tunnel Vstrav (EPA M2 EQN 2-9, ASTM E 2515-07 EQN 7)

(9) **V**strav = (85.49)(0.99 cp) {2} (.1904 $\overline{x}$ $\sqrt{\Delta P}$ "H_2O) {2} $\sqrt{\dfrac{560\ \{0\}\ T_s\ °A}{(28.558\ \{2\}\ P_s\ \text{"Hg})\ (28.56\ \text{lb./ lb. mole})}}$ = 13.91372 fps {2}

(9A) Vs = (13.91372 {2} fps)(60) = 834.823 {2} fpm

Gas Velocity in the Center of the Dilution Tunnel - Vscent (EPA M2 EQN 2-9, ASTM E 2515-07 EQN 7)

(9) Vscent = (85.49)(0.99 cp) {2} (.2025 $\overline{x}$ $\sqrt{\Delta P}$ "H_2O) {2} $\sqrt{\dfrac{560\ \{0\}\ T_s\ °A}{(28.558\ \{2\}\ P_s\ \text{"Hg})\ (28.56\ \text{lb./ lb. mole})}}$ = 14.20125 fps {2}

(9A) Vs = (14.20125 {2} fps)(60) = 852.075 {2} fpm

EPA M5G1 Section 4.2.2, ASTM E 2515-07 EQN 1 Adjustment Factor for Center of Tunnel Pitot Tube Location

Fp = Vstrav/ Vscent = 13.91372 ÷ 14.20125 = 0.97975

Average Stack Gas Dry Volumetric Flow Rate - Qsd (EPA M2 EQN 2-10, ASTM E 2515-07 EQN 3)

(10) Qsd = 3600(1 - 0.04 Bws)(13.91372 {2} fps)(.1963 {3} ft²)[(528 °A)(28.558 {2} Ps "Hg)/(560.0 {0} T_s °A)(29.92" Hg) =

9494.726 {1} dscfhr (or dscfh)

(10A) 9494.726 {1} dscfhr ÷ 60 = 141.579 {1} dscfmin (or dscfm)

Note: Number in { } under blank lines denotes number of decimals to be used. If a blank calls for an answer already calculated, use the number of decimals previously specified for that answer.

WOODSTOVE DATA SHEET #4-1: INITIAL FILTER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date 1-20-09 Time 1149 By PDG Front Half X Back Half X

Manufacturer: Pall P/N 60115 Size: 110 Lot.No.: 70726 Grade: A/E Glass

Filter #	First Wt	2009 Date	Time	By	Second Wt	Date	Time	By	Third Wt	2009 Date	Time	By
700	.6873	1-22	1331	JRP	.6877	1-23	1417	PDG				
701	.6871		1330	JRP	.6878		1419	PDG	.6877	1.26	1421	JRP
702	.6816		1329	JRP	.6825		1420	PDG	.6824	1.26	1920	JRP
703	.6761		1328	JRP	.6762		1421	PDG				
704	.6727		1327	JRP	.6732		1422	PDG				
705	.6833		1326	JRP	.6837		1423	PDG				
706	.6946		1325	JRP	.6948		1424	PDG				
707	.6773		1324	JRP	.6777		1425	PDG				
708	.6701		1323	JRP	.6702		1426	PDG				
709	.6799		1322	JRP	.6809		1427	PDG	.6806	1.26	1419	JRP
710	.6587		1321	JRP	.6590		1428	PDG				
711	.6654		1320	JRP	.6656		1429	PDG				
712	.6688		1319	JRP	.6892		1430	PDG				
713	.6864		1318	JRP	.6866		1431	PDG				
714	.6651		1318	JRP	.6655		1432	PDG				
715	.6741		1317	JRP	.6744		1433	PDG				
716	.6592		1316	JRP	.6590		1434	PDG				
717	.6531		1315	JRP	.6536		1435	PDG				
718	.6621		1314	JRP	.6623		1436	PDG				
719	.6769		1313	JRP	.6769		1437	PDG				
720	.6627		1312	JRP	.6628		1438	PDG				
721	.6567		1311	JRP	.6569		1439	PDG				
722	.6539		1310	JRP	.65340		1440	PDG				
723	.6552		1309	JRP	.6552		1441	PDG				
724	.6655		1308	JRP	.6656		1442	PDG				

Checked by: A.T. Myers Date: 1/27/09 Time 1632

QA REWEIGH

Filter #	WT	Date	Time	By
703	.6761	1/27/09	1639	ATM
708	.6703		1640	ATM
715	.6749		1642	ATM

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
57	72	38	1-22-09	1138	ATM
58	75	33	1-23-09	1150	PDG
56	76	25	1-26-09	1359	JRP
58	72	31	1/27/09	1530	PDG

Post	1-22	1-23	1-26
0.0000	0.0000	0.0000	0.0000
100.0000	99.9994	99.9993	99.9993

WST5-Form9, Pg3, Rev6/90

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Into Dessicator: Date: 9.04.08 Time: 13:33 By: JRP

Beaker #	First Wt	2008 Date	Time	By	Second Wt	2009 Date	Time	By	Third Wt	2009 Date	Time	By
24	73.2197	12/17	1628	JRP	73.2186	1/20	1000	PDG	73.2188	1/20	1635	JRP
25	72.6524		1625	JRP	72.6512		1002	PDG	72.6514		1635	JRP
26	71.7887		1631	JRP	71.7881		1007	PDG	71.7877		1626	JRP
28	70.5985		1627	JRP	70.5976		1003	PDG	70.5977		1632	JRP
29	71.5207		1635	JRP	71.5191		1008	PDG	71.5193		1637	JRP
30	70.7867		1629	JRP	70.7855		1005	PDG	70.7856		1627	JRP
33	53.1490		1632	JRP	53.1483		1012	PDG	53.1486		1633	JRP
34	53.2618		1636	JRP	53.2609		1014	PDG	53.2609		1628	JRP
35	53.2826		1637	JRP	53.2817		1016	PDG	53.2815		1629	JRP
36	53.5752		1638	JRP	53.5742		1010	PDG	53.5744		1634	JRP
42												
43	53.2325		1633	JRP	53.2315		1011	PDG	53.2319		1631	JRP

Checked By: A.T. Myam Date: 1/23/09 Time: 1145

QA REWEIGH

Beaker #	WT	Date	Time	By
35	53.2820	1/23/09	1146	ATM
26	71.7882	1/23/09	1147	ATM
43	53.2323	1/23/09	1149	ATM

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
52	70	25	12/17/08	1619	JRP
58	74	37	1/20/09	0950	PDG
57	73	33	1/20/09	1613	JRP
57	72	38	1/23/09	1138	ATM

WST5-Form9, Pg3, Rev6/90

WOODSTOVE DATA SHEET #4-2:
INITIAL BEAKER WEIGHTS (TARE WEIGHTS)

Blank done 12/10/07

Into Dessicator: Date: 10/12/07 Time: 0801 By: GRP

Beaker #	First Wt	Date	Time	By	Second Wt	Date	Time	By	Third Wt	Date	Time	By
22	71.8343	10/22/07	1358	GRP	71.8332	11/10/07	1938		71.8330	11-11-07	1748	Dm
24	73.2192		1400	GRP	73.2190	11/10/07	1940		73.2193	11-11-07	1746	Dm
25	72.6516		1401	GRP	72.6512	11/10/07	1944	←	Blank			
X 26	71.7895		1403	GRP	71.7888	11/10/07	1939		71.7886	11-11-07	1747	Dm
27	72.3316		1402	GRP	72.3314	11/10/07	1945					
28	70.5979		1404	GRP	70.5975	11/10/07	1941		70.5977	11-11-07	1745	Dm
39	53.1508	↓	1405	GRP	53.1500	11/10/07	1942					
37	53.7237	11/10/07	1945	ATM	53.7238	11/11/07	1743	Dm				

Checked By: ______________ Date: ______________ Time: ______________

QA REWEIGH

Beaker #	WT	Date	Time	By
27	72.3315	11-11	1740	Dm
25	72.6515	11-11	1741	Dm
39	53.1509	11-11	1744	Dm

2nd

Post weighing LSD
0.00009 0.0000
[illegible] 00009h

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
57	68	50	10/22/07	1344	GRP
			11/10		

WST5-Form9 Rev4/90
Unit Kuma Ashwood
Run # EPA 5
Date: 2/20/09

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

50 ml

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	2009 Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
25	72.6642	2/23	0925	PDG	72.6562	2/24	1007	ATM	72.6570	2/25	1129	PDG	72.6572	2/26	1331	JRP

FINAL FILTER WEIGHTS

	Filter #	Into Dessic	2009 Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
F	714	.7330	2/20	1945	ATM	.7322	2/21	1548	ATM	.7325	2/22	1240	JR	.7331	2/23	1424	PDG
						.7324	2/24	1012	ATM	.7322	2/25	1134	PDG				
R	713	.6871	2/20	1945	ATM	.6870	2/21	1535	ATM	.6874	2/22	1238	JR	.6873	2/23	1420	PDG
						.6872	2/24	1012	ATM								

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By

Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	2009 Date	Time	By	WB	DB	%RH
1	2/21	1519	ATM	60	77	35
2	2/22	1222	ATM	47	59	37
3	2/23	1406	PDG	58	70	48
4	2/24	0953	ATM	59	76	35
5	2/25	1123	PDG	60	70	38

SCALE ROOM ENVIRONMENTAL CONDITIONS

6	2/26	1258	JRP	55	70	36
7						
8						
9						

Comments

Acetone
Lot #
041648

Blank
done
12/18/07

WST5-Form9, Pg1, Rev4/90
Unit Kuma Ashwood
Run # EPA 5
Date: 2/20/09

WOODSTOVE DATA SHEET #4-3: CONSTANT FINAL WEIGHTS

Tare 72.6512

FINAL BEAKER WEIGHTS

Beaker #	Into Dessic	2007 Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
25	✓	12/12	1546	JRP	72.6508	12/13	1342	JRP	72.6511	12/14	1347	Jm				

FINAL FILTER WEIGHTS

Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By

QA REWEIGH: FINAL WEIGHTS

Date	Beaker #	Final Wt	By
Date	Filter #	Final WT	By

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	2007 Date	Time	By	WB	DB	%RH
1	12/13	1307	JRP	55	73	29
2	12/14	1321	JRP	57	75	31
3						
4						

SCALE ROOM ENVIRONMENTAL CONDITIONS

6						
7						
8						
9						

Comments

WOODSTOVE DATA SHEET 4-4 SCALE QC RECORD SHEET

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

FROM: 9/27/2007
THROUGH: 12/7/2007

Level	Recalibrated	130 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	129.9998	99.9998	10.0000	1.0000	0.1000	0.0199	9/27/07	1402	GRP	55	67	45
✓	Y	129.9995	99.9996	10.0001	1.0000	0.1000	0.0200	9/28/07	1335	GRP	57	69	46 ATM
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0200	10/1/07	1505	ATM	58	70	48
✓	N	129.9995	99.9996	10.0000	1.0001	0.1000	0.0199	10/2/07	1611	GRP	56	68	46
✓	N	129.9997	99.9997	9.9999	1.0001	0.1000	0.0199	10/3/07	1122	GRP	56	68	46
✓	N	129.9996	99.9996	10.0000	1.0000	0.0999	0.0199	10/4/07	1225	GRP	55	67	45
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	10/5/07	0750	GRP	51	62	45
✓	N	129.9997	99.9997	9.9999	1.0000	0.1000	0.0199	10/5/07	1513	GRP	56	69	43
✓	Y	129.9996	99.9996	10.0000	1.0001	0.1001	0.0200	10/9/07	1505	ATM	58	71	44
✓	N	129.9996	99.9997	10.0000	1.0001	0.1001	0.0200	10/12/07	1259	ATM	58	70	48
✓	Y	129.9995	99.9996	9.9999	1.0000	0.1000	0.0199	10/22/07	1344	GRP	57	68	50
✓	Y	129.9996	99.9997	9.9999	1.0000	0.1000	0.0199	10/29/07	1338	GRP	53	63	50
✓	N	129.9995	99.9995	10.0000	1.0000	0.1000	0.0200	10/30/07	0933	ATM	56	70	40
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1000	0.0199	10/30/07	1457	GRP	55	70	36
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	10/31/07	1528	GRP	57	75	30
✓	Y	129.9996	99.9996	9.9999	1.0000	0.0999	0.0199	11/2/07	1238	GRP	52	67	33
✓	Y	129.9996	99.9996	10.0000	1.0001	0.1000	0.0199	11/5/07	0730	GRP	57	73	35
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1001	0.0201	11/9/07	1550	ATM	58	70	48
✓	N	129.9996	99.9997	10.0000	1.0000	0.1000	0.0200	11/10/07	1835	ATM	58	71	44
✓	Y	129.9997	99.9997	9.9999	1.0000	0.1000	0.0199	11/11/07	1810	ATM	55	69	39
✓	N	129.9997	99.9996	9.9999	1.0000	0.1000	0.0199	11/12/07	0822	GRP	54	67	41
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	11/13/07	1226	ATM	58	72	41
✓	N	129.9998	99.9997	9.9999	0.9999	0.1000	0.0200	11/14/07	1710	GRP	58	73	39
✓		QC Services Audit 11/14/07											
✓	Y	129.9997	99.9997	10.0000	1.0000	0.1000	0.0200	11/15/07	1358	ATM	59	72	45
✓	N	129.9996	99.9996	9.9999	0.9999	0.1000	0.0200	11/16/07	1600	GRP	58	71	44
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	11/18/07	1758	ATM	60	74	43
✓	Y	129.9997	99.9997	10.0000	1.0001	0.1001	0.0200	11/19/07	1143	ATM	56	70	40
✓	Y	129.9995	99.9996	10.0000	1.0000	0.1000	0.0199	11/20/07	1416	GRP	54	69	35
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	11/21/07	1110	ATM	57	70	44
✓	N	129.9995	99.9996	10.0000	1.0000	0.1000	0.0199	12/3/07	0730	GRP	55	69	40
✓	N	129.9996	99.9996	10.0000	1.0000	0.0999	0.0200	12/6/07	1125	ATM	54	67	44
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/7/07	1348	GRP	55	69	40

WOODSTOVE DATA SHEET 4-4 SCALE QC RECORD SHEET

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

FROM: 12/8/07
THROUGH: 2/3/08

Level	Recalibrated	130 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/8	1215	ATM	57	73	35
✓	N	129.9996	99.9996	10.0000	1.0000	0.1001	0.0200	12/8	1910	ATM	57	72	38
✓	N	129.9997	99.9996	10.0000	1.0000	0.1000	0.0199	12/9	1935	ATM	55	72	31
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/10	1953	ATM	56	72	34
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/11	1618	GRP	57	76	28
✓	N	129.9997	99.9996	10.0000	1.0000	0.0999	0.0199	12/12	1505	GRP/ATM	56	74	30
✓	N	129.9996	99.9996	9.9999	0.9999	0.1000	0.0199	12/13	1307	GRP	55	73	29
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	12/14	1321	GRP	57	75	31
✓	N	129.9998	99.9998	9.9999	1.0001	0.1000	0.0199	12/15	1602	GRP	57	75	31
✓	Y	129.9996	99.9997	9.9999	1.0000	0.1000	0.0199	12/17	0817	GRP	55	73	29
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/18	0853	GRP	58	75	34
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0199	12/19	0812	GRP	55	72	31
✓	Y	129.9995	99.9996	10.0000	1.0001	0.0999	0.0199	12/20	0916	GRP	57	71	41
✓	Y	129.9998	99.9997	10.0000	1.0000	0.1000	0.0199	12/21	1085	ATM	55	70	36
✓	N	129.9997	99.9996	10.0000	1.0000	0.10000	0.0200	12/22	1434	[illegible]	54	66	44
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	12/23	0915	ATM	57	70	44
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	12/26	1230	ATM	57	70	44
✓	N	129.9997	99.9997	10.0000	1.0000	0.1000	0.0200	12/27	1030	ATM	56	72	34
✓	N	129.9998	99.9997	9.9999	1.0000	0.1000	0.0200	1/8/08	1342	GRP	54	68	38
✓	N	129.9997	99.9997	10.0000	1.0001	0.1000	0.0200	1/9/08	0742	GRP	55	70	36
✓	N	129.9998	99.9998	10.0000	1.0000	0.1000	0.0199	1/11/08	1040	ATM	59	73	42
✓	Y	129.9996	99.9997	10.0000	1.0000	0.1000	0.0199	1/16/08	1221	GRP	51	72	18
✓	N	129.9999	99.9998	10.0000	1.0000	0.1000	0.0199	1/17/08	1237	GRP	56	71	37
✓	N	129.9998	99.9998	10.0000	1.0000	0.0999	0.0200	1/18/08	1116	GRP	56	71	37
✓	Y	129.9995	99.9996	9.9999	1.0001	0.1000	0.0199	1/21/08	1142	GRP	56	72	34
✓	N	129.9995	99.9996	10.0000	1.0001	0.1000	0.0199	1/22/08	1513	GRP	56	71	37
✓	Y	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	1/23/08	0805	GRP	54	69	36
✓	Y	129.9996	99.9996	10.0000	1.0000	0.1000	0.0200	1/24/08	0758	GRP	54	70	33
✓	N	129.9998	99.9997	10.0000	1.0000	0.1000	0.0199	1/24/08	1450	GRP	56	71	37
✓	N	129.9997	99.9996	10.0000	1.0000	0.1000	0.0200	1/31/08	1505	GRP	55	69	38
✓	N	129.9996	99.9996	10.0000	1.0000	0.1000	0.0199	2/1/08	1029	GRP	54	69	36
✓	N	129.9996	99.9996	9.9999	1.0000	0.1000	0.0199	2/2/08	1620	ATM	58	72	41
✓	N	129.9996	99.9997	10.0000	1.0001	0.1000	0.0200	2/3/08	1710	ATM	57	70	44

WOODSTOVE DATA SHEET 4-4 ANALYTICAL BALANCE QC RECORD SHEET

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

FROM: 12/20/08
THROUGH: 2/17/09

Level	Recalibrated	140 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
✓	N	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	12/20/08	1430	ADM	58	72	42
✓	N	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	12/23/08	1057	JRP	60	76	38
✓	N	139.9994	99.9994	9.9999	1.0001	0.1000	0.0200	12/24/08	1019	ATM	59	72	45
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0200	12/26/08	1142	ADM	57	72	45
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0200	12/28/08	1050	ADM	60	75	37
✓	N	139.9994	99.9994	10.0000	.9999	0.1000	0.0199	1/05/09	1157	PDG	58	75	34
✓	N	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	1/6/09	1845	ATM	60	75	37
✓	N	139.9995	99.9996	9.9999	1.0000	0.1000	0.0199	1/7/09	1530	JRP	58	70	48
✓	N	139.9994	99.9994	9.9999	.9999	0.1000	0.0199	1/8/09	1356	PDG	60	72	49
✓	Yes	139.9993	99.9994	9.9999	1.0000	0.1000	0.0200	1/09/09	1053	PDG	58	72	42
✓	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	1/11/09	1128	JRP	55	72	31
✓	Yes	139.9994	99.9995	9.9999	1.0000	0.1000	0.0199	1/12/09	0845	PDG	59	75	38
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0200	1/13/09	0825	JRP	58	74	37
✓	yes	139.9993	99.9994	9.9999	0.9999	0.1000	0.0199	1-14-09	1212	PDG	57	72	38
✓	NO	139.9993	99.9993	9.9999	1.0000	0.0999	0.0199	1/14/09	1420	JRP	59	75	37
✓	NO	139.9992	99.9993	10.0000	1.0000	0.0999	0.0199	1-15-09	1128	JRP	58	74	37
✓	yes	139.9994	99.9995	9.9999	0.9999	0.1000	0.0199	1-20-09	0950	PDG	58	74	37
✓	no	139.9993	99.9994	10.0000	0.9999	0.1000	0.0199	1-20-09	1230	PDG	56	71	37
✓	NO	139.9993	99.9993	9.9999	1.0000	0.0999	0.0199	1-20-09	1613	JRP	57	73	35
✓	No	139.9994	99.9994	9.9999	1.0000	0.1001	0.0200	1/22/09	1138	ATM	57	72	38
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	1/23/09	1150	PDG	58	75	33
✓	YES	139.9992	99.9993	10.0000	1.0000	0.0999	0.0200	1/26/09	1359	JRP	56	76	25
✓	no	139.9994	99.9995	10.0000	1.0000	0.1000	0.0199	1/27/09	1530	PDG	55	72	31
✓	No	139.9993	99.9993	10.0000	1.0001	0.1001	0.0200	1/28/09	1452	ATM	61	75	41
✓	YES	139.9993	99.9994	10.0000	1.0000	0.1000	0.0199	1-29-09	1436	JRP	58	77	29
✓	no	139.9995	99.9995	9.9999	0.9999	0.1000	0.0199	1/30/09	1256	PDG	60	72	49
✓	Yes	139.9993	99.9994	9.9999	1.0000	0.1000	0.0199	2/1/09	1200	ATM	58	74	37
✓	NO	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	2/2/09	1350	JRP	58	77	29
✓	yes	139.9995	99.9996	9.9999	1.0000	0.1000	0.0199	2/5/09	1118	PDG	59	72	45
✓	NO	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	2/6/09	1150	JRP	57	74	33
✓	No	139.9994	99.9994	10.0000	1.0001	0.1000	0.0200	2/9/09	1015	ATM	49	70	19
✓	NO	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	2/16/09	1551	PDG	61	78	36
✓	NO	139.9993	99.9994	9.9999	1.0000	0.1000	0.0200	2/17/09	1439	JRP	56	72	35

WOODSTOVE DATA SHEET 4-4 ANALYTICAL BALANCE QC RECORD SHEET

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

FROM: 2/10/09
THROUGH:

Level	Recalibrated	140 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
Y	Y	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	2/10/09	1800	ATM	55	70	36
Y	Y	139.9993	99.9994	9.9999	1.0000	0.1000	0.0199	2-19-09	1248	JRP	56	73	32
Yes	Y	139.9993	99.9994	9.9999	0.9999	0.1000	0.0199	2/20/09	1018	PDG	57	74	33
Yes	Y	139.9993	99.9994	10.0000	1.0000	0.1000	0.0200	2/21/09	1519	ATM	60	77	35
Yes	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	2/22/09	1222	ATM	47	59	37
Y	Yes	139.9994	99.9994	9.9999	0.9999	0.1000	0.0199	2/23/09	1406	PDG	58	70	48
Yes	No	139.9994	99.9991	9.9999	1.0000	0.1000	0.0200	2/24/09	0953	ATM	59	76	35
Yes	Yes	139.9995	99.9995	9.9999	1.0000	0.1000	0.0199	2/25/09	1123	PDG	60	76	38
Yes	Yes	139.9994	99.9994	9.9999	1.0000	0.1000	0.0199	2-26-09	1258	JRP	55	70	36
YES	YES	139.9993	99.9993	9.9999	1.0001	0.1001	0.0200	2/28/09	1330	ATM	57	74	33
Yes	Yes	139.9995	99.9995	9.9999	0.9999	0.1000	0.0199	3/3/09	1431	PDG	59	76	35
Yes	NO	139.9993	99.9995	9.9999	1.0000	0.1000	0.0199	3/4/09	1556	JRP	56	70	40
Yes	No	139.9994	99.9994	9.9999	1.0001	0.1001	0.0200	3/5/09	1350	ATM	60	75	40
Yes	No	139.9993	99.9993	9.9999	1.0000	0.1000	0.0200	3/7/09	0850	ATM	57	71	41
Yes	Yes	139.9993	99.9993	10.0000	1.0001	0.1000	0.0200	3/8/09	1323	ATM	55	70	36
Yes	Yes	139.9993	99.9993	9.9999	1.0000	0.1000	0.0199	3/10/09	1212	PDG	50	75	10

Woodstove Particulate
Catch Processing Sheet
Woodstove Data Sheet #5
EPA M5G-1

Unit: Kuma Ashwood
Run: EPA 5
Date: 2/20/09
Technicians: A,T,M
Revised 1/16/98-Data Sheet #5

Filters

Filter # (Front) 714 Beaker # 25
.7324 Final Wt. .7322 g Ml 50
Tare Wt. .6655 g Desc. Acetone
Net Wt. .0667 g
66.9

Final Wt. 72.6572 g 72.6562
Tare Wt. 72.6514 g
Net Wt. .0058 g .0048

Filter # (Rear) 713 Beaker # ______
Final Wt. .6872 g Ml ______
Tare Wt. .6866 g Desc. ______
Net Wt. .0006 g

Final Wt. ______ g
Tare Wt. ______ g
Net Wt. ______ g

Acetone Blank Calculation: Blank Date: 12/8/07

Blank Beaker # 25 Final Wt. 72.6511 g
Ml 50 Tare Wt. 72.6512 g
Desc. Acetone Net Wt. -0.0001 g = 0.0000

0.0000 g ÷ 50 ml = 0.00000 g/ml

Blank Residue Value Calculation:

0.00000 g/ml acetone X 50 ml acetone = 0.0000 g
Blank Residue Value

Total Particulate Catch Calculation

Filter: .0067 g
Filter: .0006 g
Beakers: .0058 g (Total Catch) – 0.0000 g (Blank Residue Value) = .0058 g

Total Catch = .0731 g

Unit Kuma Ashwood
Run # EPA
Date 2/20/09
Technician ATM JRP PDG
WST6-Form1,Rev8/96

MISCELLANEOUS TEST DATA
WOODSTOVE DATA SHEET #8

Useable Firebox Dimensions: See QC Section Useable Volume: 2.094 ft^3

Dilution Tunnel Draft (If applicable): Start .000 Stop .000 "H_2O

Test Chamber Air Velocity: Start: 00.0 Stop: 00.0 Avg: 00.0 ft/min

Wet Bulb/ Start: WB: 58 °F DB: 74 °F 1.10% Amb Moisture 36 %RH

Dry Bulb Stop: WB: 60 °F DB: 78 °F 1.10 % Amb Moisture 33 %RH

$\overline{X}$ = 1.10 % Ambient Moisture $\overline{X}$ = 34.5 % Relative Humidity (RH)

Empty Stove Wt: 440.2 lbs.

Empty Stove Wt with Stack (Inc. Oil Seal) Wet: 763.8 lbs. Dry: 763.8 lbs.

Empty Stove Wt with Stack and Ash Ash: — lbs. Total: — lbs.

Kindling Wt. Total 5.3 lbs. Paper: .4 lbs. Wood: 4.9 lbs.

Pre Burn Fuel Wt. 10.688 + 14.070 + 10.658 Total: 35.416 lbs.

Total Kindling and Pre Burn Fuel Wt 40.716 lbs.

Coal Bed Wt-lbs: Range(3.3 - 2.7) 767.1 - 766.5 lbs. Actual: 3.0 lbs. 766.8

Allowable Amount of Charcoal that can be removed:

Coal Bed Wt. Range $\left(\frac{3.3}{\text{Upper Wt.}} + \frac{2.7}{\text{Lower Wt.}} /2\right) \times .25 =$ 0.7 lbs.

Test Fuel Wt-lbs: Ideal 14.7 lbs. Range: 11.1 - 13.3 lbs. Actual: 13.332 lbs.

Test Fuel Size (pcs.)(.75 x 1.5 x 5" Flanges) 1.600 lbs 16 Pcs.

2 x 4's x 16.0 " 3 Pcs 5.966 lbs. 44.75 %

4 x 4's x 16.0 " 2 Pcs 7.366 lbs. 55.25 %

5.0526 Kg.

Est. Dry Burn Rate (Kg/Hr.) $\frac{13.332 - (13.332 \times .16449)}{2.2046} \times \frac{60}{275} =$ 1.1024 Est. Dry Burn Rate (Kg/Hr)

Est EPA Heat Output(HO_E) (Avg BTU's/Hr) (19,140) x $\frac{63}{100}$ x 1.1024 = 13,293 Est Heat Output (HO_E) BTU's/Hr

Comments: 245 mins = 1.2374 kg/hr.

Stove Operating Data
Woodstove Test Data Sheet #9
Cold Start

Unit: Kuma Ashwood
Run: EPA 6
Date: 2/20/09
Technician(s): AT Myren
Data Sheet#9–Rev 1/98-Pg.2

Fire Started: 06:50

Warm up and Preburn: Primary Air: Wide open from ignition until the start of preburn when the primary air control(s) was (were) adjusted to the run setting of .428" orifice. At the run setting until the start of the test. 2.436 thr. rod

Secondary Air: No Controls, Naturally drafted

Secondary Burn Bypass: N/A

Charcoal Bed Preparation: Broke up, raked and leveled the coal bed prior to the addition of each warm up/pre burn fuel charge. Starting 1:30 before the start of the test, broke up, raked and leveled the coal bed. In stove for 32 seconds.

Test: Door wide open during loading 1 min 15 sec, then Closed

Primary Air: Wide open from the start of the test (0:00) until 4:45. Adjusted to the run setting of .428" between 4:45 and 5:00. At the run setting of .428 open at 5:00 into the run.

Secondary Air: No Controls, Naturally drafted.

Secondary Burn Bypass: N/A

Fan: ON/OFF during the warm up, ON/OFF Low during the preburn, ON/OFF at the start of test, ON/OFF for the first 30 minutes of test, ON/OFF Low at 30 minutes into test, ON/OFF for the rest of the test.

Test Run Anomalies: This run went "South" right after 5:00. Got a good 1st 5 but then there was not enough to keep 2nd 5 going. Overrun start

Unit Kuma Ashwood
Run # EPA 5
Date 2/ 20 /09
Technician ATM
Page 1 of 4
WST7-Form2-A, Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-1

Wood Data: Kindling: A mix of the below grades

	Size	Mill	Grade	Species
Pre Burn	2X4	Forest Grove	#2, Std & Btr	D. Fir, Sfc Grn
Test Fuel	2X4	Forest Grove	#2, Std & Btr	D. Fir, Sfc, Grn
	4X4	Forest Grove	No. 1	D. Fir, Sfc, Grn

All grades WCLB Rules unless otherwise noted.

Warm up Information:

1st Warm up/Pre Burn Fuel charge (10.688 lbs) added at 0712.
2nd Warm up/Pre Burn Fuel charge (14.070 lbs) added at 0755.
3rd Warm up/Pre Burn Fuel charge (10.658 lbs) added at 0852.
4th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.
5th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.
6th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.
7th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.
8th Warm up/Pre Burn Fuel charge (_____ lbs) added at _____.

1st Rick 4-12" 4-16" 2X4's 3rd Rick 4-12", 3-16" 2X4's
2nd Rick 8-16" 2X4's

The coals were scooped out of the stove immediately prior to adding the 3rd pre burn/warm up fuel charge. The stove lost 0 lbs. 2.0 lbs. of coals were put back in the stove after the scoop.

All pre burn/warm up fuel pieces were either 12 or 16 inches long. All preburn pieces/fuel charges were "ricked" in the stove. The pieces in the bottom layer in each rick contained 2 pcs that were 12 or 16 inches long and were loaded flat and perpendicular to the door. The pieces in the second layer in each rick were loaded on their side (edge) approximately parallel to the door and contained 3 or 4 pcs 16 inches long. The third layer (and fourth layer if present) was loaded flat, perpendicular to the door and contained 2 pcs 12 or 16 inches long. The majority of the pieces in each rick were in the second layer which had an approximate 0.5-1.0" space between pieces. (The loading directions indicate the direction of the longest dimension on each piece relative to the loading door opening.) Each pre burn/warm up fuel charge normally weighs within the weight range allowed for the actual test fuel charge

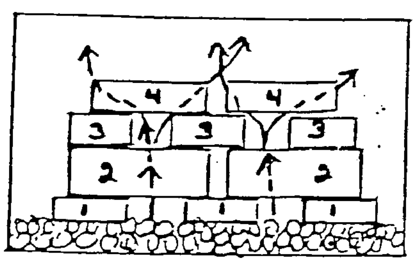
Unit Kuma Ashwood
Run # EPA 5
Date 2/ 20 /09
Technician AJM
Page 2 of 4
WST7-Form2-A, Rev 6/90

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-2

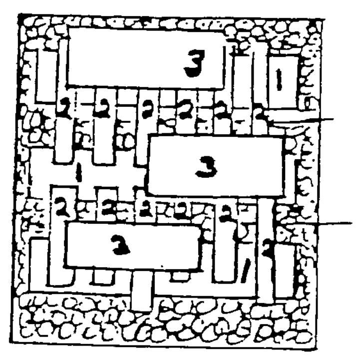
Warm up Information (cont.):

Each warm up/preburn fuel charge was ricked in exactly (as much as possible) the same manner and the weight of each rick was usually within the allowable weight range for the test fuel charge. The physical arrangement and alignment of each rick was designed to accomplish three (3) things: (1)The bottom layer was nestled firmly into the coal bed and was as close to being level with the bottom of the stove as possible, thus providing a stable loading platform for the rest of the rick, keeping it in a ricked state (as opposed to a col- lapsed or fallen down state) untill the rick reached the charcoal stage and sags or collapses of its own accord. (2) It enhances the flow of primary air through the ricked preburn fuel charge, for the primary air would flow through the spaces between the pieces in the first layer and then up through the spaces between the pieces in the second, third and, if present, fourth layers. (3) It maximized, as much as possible, the surface to volume ratio of each preburn fuel charge, thereby allowing the fire immediate access to as much wood surface as possible and, thereby, insuring uniform charcoalization. All three of these enhance combustion and so get the stove as hot as possible during the warm up period, therby maximizing the amount of heat (BTU's) stored in the stove. The actual preburn was not started until the stove surface temperatures had maximized and stabilized, thus indicating that the amount of heat stored in the stove had peaked. For this stove, the thermal storage was monitored using the Stove Top T/C surface temperature(s) and the peak value(s) obtained were 1000 °F.

898
1000



Front View



Top View

The arrows indicate the direction of the air flow through the rick.

The primary air was adjusted to the run setting of .428" open 3.5 lbs above the upper charcoal bed weight.
(2.436" on thr. Rod.)

Unit Kuma Ashwood
Run # EPA 5
Date 2/20/09
Technician ATM
Page 3 of 4
WST5-Form2-Rev11/89

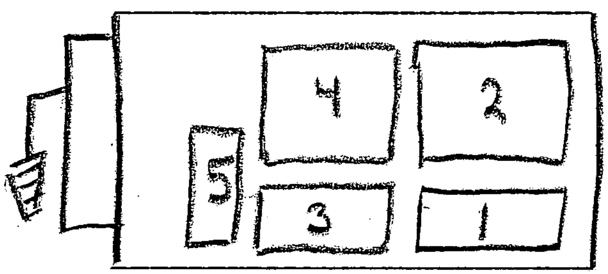
WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-3

Additional Comments: Test Start Sequence: (1) Turned Fan off (2) Adjusted Primary Air Control to Wide Open (3) Opened door (4) Loaded fuel (5) cleared coals away from the LPAO (6) Closed door.

TOTAL ElAPSED Time: 1:15
Photo @ 1:45

Test Fuel Charge Loading Information:

Test Fuel Charge and Loading Sequence Diagram



SIDE of stove view
4 X 4's: 2,4
2 X 4's: 1,3 & 5
Loading Sequence: 1,2,3,4 & 5 last
Driest Pcs in Load 5,3

Loaded the test fuel charge on an essentially level, Medium sized, Avg to Cool coal bed (in appearance, color and temperature for a Med Low (1.0-1.25) burn rate. Load: 1:15 Ignition: 1:10
1:16 Vertical Column of flame up to baffle (VC)
1:45 Photo
2:50 6.15/.82 (% CO_2 / % CO) M = Med Smoke
3:46 Gas Balance 8.47/.84 Front Tube igniting Secondaries the full width of 4 & 5. L/ML
4:45-5:00 Primary Air Control Adjusted to the run Setting
5:00 Flames decreasing. Maintained a hot pocket of coals underneath and behind pc 5. The back of the front tube was orange (hot) & Secondaries
5:30 Secondaries decreasing
6:11 Secondaries at top of VC and just behind it,
6:45 " still decreasing 5.73/1.24 M

Unit Kuma Ashwood
Run # EPA 5
Date 1/20/09
Technician ATM
Page 4 of 4
WST5-Form2-Rev10788

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-4

Additional Comments: 7:11 VC still decreasing
8:03 VC up to baffle w/ secondaries flashing @ top of VC
10:35 VC still increasing a bit right of center
11:10 VC decreasing - down to top of pc 5
14:11 VC up maybe just a little bit
14:45 Secondary flashes in VC
15:30 5.48/1.29 VC flickers right of center again, M/MH
16:21 VC flickers increasing in height
16:50 Secondary flashes above pc 4 left of center
17:17 flames under center Bottom front edge of 4 occ.
18:19 Steady (running) secondaries above pc 4,
VC height decreasing (Primary Secondary Flip Flop
20:42 VC flickers increasing in height
21:35 Secondaries just about went out 7.92/1.62
22:27 flames on center top edge of 5
25:20 7.73/1.52
26:03 Secondaries Forward part front tube on L side.
29:03 Gas Balance 13:03/1.29
30:00 Fan On
31:00 Out of balance. Stretchitis. Lots of yellow flames in VC and up the front of pc 5 occasionally.
This was not a good start.

Unit: Kuma Ashwood
Run: EPA 5
Date: 2/20/09
Technician: AVM JRP PUG
WST1-Form7-Rev11/89

FUEL MOISTURE
WOODSTOVE TEST DATA SHEET #10

5kg. = 11.024 lbs. 1 kg. = 2.204 lbs

Room Temperature: 60.4 °F

Correction Factor: +1.0

NOTE: Record readings to the nearest 0.5% moisture
Uncor Values are corrected for temperature: Yes ✓ No ____
Time Test Fuel Moisture Readings taken at: ____
Calibration Checks: X ____ Y ____ 12.0 11.7 22.0 22.0

	Pc #	Dimen	Use	Top Uncor	Top Cor	Bottom Uncor	Bottom Cor	Side Uncor	Side Cor	Piece Avg Corrected
	1	3 pcs	K	8.5	8.95	7.5	7.85	8.5	8.95	8.583
	2									
	3									
	4	2x4 - 8'	P	19.0	20.3	19.5	20.9	20	21.4	20.867
	5	↓	↓	22	23.7	22.5	24.3	21	22.6	23.533
	6			19	20.3	19	20.3	18.5	19.8	20.133
	7			19	20.3	19.5	20.9	19.5	20.9	20.700
	8			18	19.2	18	19.2	18.5	19.8	19.400
	9									104.633
	10	"								
1.3	11	2x4 - 16	T	18	19.2	18.5	19.8	19	20.3	19.767
1.906	12	↓	↓	19.5	20.9	20	21.4	19	20.3	20.867
1.496	13			18	19.2	18	19.2	18	19.2	19.200
	14	"								
3.476	15	4x4 - 16	T	18	19.2	18	19.2	18.5	19.8	19.400
3.548	16	↓	↓	18	19.2	18	19.2	18	19.2	19.200
	17									98.434
	18									
1.600	19	Spacers	T	19	20.3	19	20.3	18	19.2	19.933
	20								out	Spacers

	Kindling	Pretest Fuel	Test Load
% Moisture - Dry Basis:	8.583 %	20.9266 %	19.6868 %
% Moisture - Wet Basis:	7.905 %	17.305 %	16.449 %

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

13.332
7.366 wr

1 10.688
2 14.070
3 10.658

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

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

Unit: Kuma Ash wood
Run#: EPA 5
Date: 2/ 20 /09
Technician: A.T.Myren
WST2-form11-Rev 6/90

WOOD DENSITY DETERMINATION
WOODSTOVE TEST DATA SHEET #11

Wood Piece: Nominal Dimensions: 4x4 3.5 x 3.5 x 5 11/16"

Depth (D): 8.860 cm

Width (W): 8.875 cm

Length (L): 14.515 cm
14.615 cm
14.910 cm
14.470 cm

Length $\bar{X}$ = 14.6275 cm

Volume: 1150.197 cm^3
(D X W X L)

MOISTURE: Room Temperature: 60.4 °F Correction Factor: +1.0

Uncorrected Meter Readings Corrected for temperature: Yes ✓ No ___

NOTE: Record moisture meter readings to the nearest 0.5%

	Uncor	Cor
Top:	15.5	16.5 %
Bottom:	17	18.1 %
Side:	15	15.9 %
$\bar{X}$:		16.833 %

Avg % Moisture (Dry) 16.833 %

Aug % Moisture (Wet) 14.408 %

Scale: Leveled In ✓ Out ___
Zeroed: In ✓ Out ___

Wet Weight: 566.8 g Dry Weight: 484.6 g

% Moisture Dried Basis: 14.502 %
[1 - (Dry Wt ÷ Wet Wt)] X 100

	Date	Time	Temp
Into Dryer	2/20/09	0845	200 °F
Out of Dryer	3/13/09	0915	192 °F

(Minimum Time in Dryer: 24 hrs.) Minimum Dryer Temp 100°C (212°F)

Density = 484.6 g (dry wt) ÷ 1150.197 cm^3 (volume) = 0.4213 g/cm^3

Pellet Fuel Moisture Content Determination

Tare Beaker Wt. ________ g

Wet Wt: ________ g - ________ g = ________ g
Gross Wet Wt. Tare Beaker Wt. Net Wet Wt.

Dry Wt: ________ g - ________ g = ________ g
Gross Dry Wt. Tare Beaker Wt. Net Dry Wt.

% Moisture Dried Basis: ________ %
[1 - (Net Dry Wt ÷ Net Wet Wt.)] X 100

Pre Burn 3.5 lbs. Up 770.6 lbs. Start wt.
Test Start wt. Range 767.1 - 766.5 lbs.

PRE BURN DATA
RECORD SHEET #13
WST2-Form16

BARO. PRESSURE 28.57" Hg

Unit: Kuma Ashwood Date: 2.20.09
Run: EPA5 Technician(s): ATM JRP PDC
Page: 1 of 1

Hot Box On ✓

		T/C#-3		4	5	6	7	8	9	10	17	11		
Minute Time	Scale Weight	Burn Rate	Stack	Stove Top	Left Side	Back	Right Side	Bottom	Firebox	2nd Burn [redacted]		Room Temp	Static	Raked FWD @ 36 min Comments
0 0920	770.6	0	599	690	597	380	572	374	1037	1329	1169	79	-.075	Primary Air Set at 2.436 Thr. rod .438" orifice
5 25	769.9	.7	456	819	604	383	582	385	1004	1394	1303	79	-.066	Secondary Air Set at
10 30	769.3	.6	419	918	607	389	584	390	990	1404	1313	79	-.065	Fan: Hi @ Load = Low @ shut down ✓
15 35	768.7	.6	386	878	609	393	583	392	999	1401	1327	78	-.062	Tunnel on at: 26min.
20 40	768.3	.4	365	851	608	395	583	391	984	1401	1418	79	-.059	Buckets Iced ✓
25 45	767.9	.4	333	787	606	403	583	389	991	1384	1454	79	-.056	Analyzers Spanned ✓
30 50	767.7	.2	310	734	601	418	580	386	988	1237	1299	78	-.050	Pumps turned on at: 56min
35 55	767.5	R/.2	286	669	590	438	572	383	960	1123	1231	77	-.047	530.4 ΔT ΔΔT
40 1000	767.3	.2	289	628	575	433	561	381	945	1100	989	77	-.048	515.6 -14.8
45 05	767.2	.1	264	602	553	424	543	380	899	987	950	77	-.045	Check WB/DB: 500.4 -15.2
50 10	767.2	0	253	570	537	417	527	379	860	961	891	77	-.043	486.0 -14.4
55 15	767.1	.1	244	535	517	408	509	378	833	929	867	77	-.040	469.4 -16.6
	—												—	Probe In Tunnel ✓
60 1020	767.0	.1	236	510	502	398	493	376	804	869	833	77	-.039	Tunnel ΔP 455.8-13.
65 25	766.9	.1	231	485	487	388	478	374	784	849	820	76	-.037	442.4-13.
70 30	766.8	.1	226	469	476	381	465	370	769	837	809	76	-.036	432.2 10
75														
80														
85														
90														
														Ra-kee FWD Flamed Out
														Start ΔT 430 ish

Myren Consulting Inc Data Sheet P1 of 3 Unit Kuma Ashwood Date 2 / 20 / 04 Run EPA 5

Test End Wt. 766.8 ΔT 432.2 Barometric Pressure 28. "hg Gas Flows @ 1.5" Technician(s) ATM JBP DG

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
0	1030	780.1	13.3	0	.263	5.89		14.26	.150	1.50	3.9	ML	FAN	OFF		226	-.036
05	35	779.2	12.4	.9	.306	7.62		12.84	.090	.90	8.4	M				405	-.061
10	40	779.0	12.2	.2	.294	7.32		13.00	.117	1.17	6.3	"				297	-.049
15	45	778.7	11.9	.3	.206	5.15		15.11	.129	1.29	4.0	M→MH				252	-.044
20	50	778.4	11.6	.3	.207	5.17		15.07	.133	1.33	3.9	"				244	-.043
25	55	778.0	11.2	.4	.273	6.80		13.30	.160	1.60	4.3	"				241	-.042
30	1100	777.4	10.6	F/.6	.384	9.54		10.74	.124	1.24	7.7	"	FAN	on		257	-.046
35	05	776.7	9.9	.7	.657	16.29		3.62	.199	1.98	8.2	M BaD 29:03 -	3612	2		323	-.054
40	10	776.0	9.2	.7	.672	16.66		3.48	.152	1.52	11.0	M→ML				335	-.055
45	15	775.5	8.7	.5	.654	16.22		4.05	.127	1.27	12.8	ML PC5 80% Thru	NO TRB above 4			336	-.055
50	20	774.9	8.1	.6	.602	14.93		5.41	.112	1.12	13.3	ML→L PC3 Thru VC				330	-.054
55	25	774.4	7.6	.5	.590	14.63		5.62	.129	1.29	11.3	"				321	-.053
Tot																3567	.592

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2^{nd} burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 #19	Tube 3 #20
0	1030	469	476	381	465	370	769	837	76	96	218	29	72	55	809			
05	35	495	467	359	452	367	726	1370	76	124	206	30	76	36	1157			
10	40	520	464	346	446	364	640	956	77	103	216	30	79	35	933			
15	45	489	444	330	427	361	608	870	76	98	218	30	79	35	790			
20	50	472	430	318	412	358	592	869	76	97	213	31	78	35	1019			
25	55	456	421	308	399	353	591	1005	76	96	210	31	78	35	1093			
30	1100	469	419	301	397	346	614	1292	77	98	212	32	78	35	1220			
35	05	593	423	290	412	339	681	1288	76	100	227	34	80	36	1258			
40	10	659	429	284	424	331	729	1354	77	102	234	34	80	35	1250			
45	15	704	440	277	438	324	777	1367	76	101	232	34	81	36	1248			
50	20	705	449	274	445	318	807	1369	77	101	228	33	81	35	1210			
55	25	697	463	273	456	313	843	1380	77	101	228	34	81	36	1222			
Tot		6728	5325	3741	5173	4144	8377	13957	917									

Myren Consulting Inc Data Sheet P2 of 2 Unit Kuma [illegible] Date [illegible] Run [illegible]
Test End Wt. 766.8 ΔT 432.2 Barometric Pressure 28.5 "hg Gas Flows @ 1.5" Technician(s) ATM JR PDG

Time E/T min	Time	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
60	1130	773.8	7.0	.6	.638	15.82		4.29	.157	1.57	10.1	ML→L				322	-.053
65	35	773.3	6.5	.5	.642	15.92		4.24	.149	1.49	10.7	"				326	-.054
70	40	772.7	5.9	.6	.620	15.38		4.79	.147	1.47	10.5	"				322	-.053
75	45	772.3	5.5	.4	.583	14.46		5.68	.151	1.51	9.6	M PC 2&4 fl.	No 2nds			312	-.051
80	50	771.8	5.0	.5	.580	14.39		5.67	.168	1.68	8.6	M→ML				309	-.051
85	55	771.3	4.5	.5	.595	14.76		5.34	.161	1.61	9.2	ML→L				309	-.051
90	1200	770.9	4.1	.4	.598	14.83		5.30	.154	1.54	9.6	M PC 4				307	-.050
95	05	770.5	3.7	.4	.570	14.14		5.92	.167	1.67	8.5	"				297	-.049
100	10	770.2	3.4	.3	.456	11.32		8.80	.155	1.55	7.3	"				297	-.045
105	15	769.9	3.1	.3	.395	9.82		10.32	.153	1.53	6.4	"				257	-.043
110	20	769.7	2.9	.2	.371	9.22		11.00	.136	1.36	6.8	"				248	-.041
115	25	769.5	2.7	.2	.365	9.07		11.19	.128	1.28	7.1	"				238	-.040
Tot																3546	.581

Time E/t	Time	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2nd burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 #19	Tube 3 #20
60	1130	703	472	273	465	309	866	1362	77	101	228	34	81	35	1306			
65	35	716	483	277	475	306	881	1327	77	101	229	34	82	36	1394			
70	40	718	490	286	483	304	879	1317	78	102	228	34	82	35	1321			
75	45	701	498	302	487	302	884	1313	77	101	224	34	82	36	1286			
80	50	692	503	313	488	301	890	1322	78	101	223	34	82	35	1283			
85	55	688	511	326	490	301	895	1293	78	100	226	34	82	36	1304			
90	1200	688	518	334	493	300	898	1287	78	100	232	34	82	36	1296			
95	05	682	527	341	498	300	910	1277	78	100	231	34	82	36	1283			
100	10	648	531	345	499	300	881	1113	78	98	222	34	82	36	1251			
105	15	595	527	351	494	300	855	1010	78	97	216	34	82	37	1228			
110	20	565	517	360	488	300	827	1010	78	96	221	34	81	36	1207			
115	25	535	508	373	482	300	810	1017	78	95	227	34	82	36	1175			
Tot		7931	6085	3881	5842	3623	10476	14648	933									

Myren Consulting Inc Data Sheet P3 of 5 Unit Kuma Ashwood Date 2/20/09 Run EPA 5
Test Er)t. 766.8 ΔT 432.2 Barometric Pressure 28.5 "hg Gas Flows @ 1.5" Technician(s) ATM JR PDG

Time E/T min	Time ⏲	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
120	1230	769.3	2.5	.2	.383	9.52		10.81	.115	1.15	8.3	M				235	-.038
125	35	769.2	2.4	.1	.354	8.80		11.50	.120	1.20	7.3	ML→L				225	-.036
130	40	769.1	2.3	.1	.315	7.84		12.39	.135	1.35	5.8	wisps				223	-.035
135	45	769.0	2.2	.1	.315	7.84		12.36	.141	1.41	5.6	clear				217	-.034
140	50	768.9	2.1	.1	.308	7.67		12.50	.146	1.46	5.3	"				215	-.034
145	55	768.8	2.0	.1	.312	7.76		12.36	.156	1.56	5.0	"				210	-.034
150	1300	768.7	1.9	.1	.312	7.76		12.37	.153	1.53	5.1	Charcoal				208	-.031
155	05	768.6	1.8	.1	.310	7.72		12.34	.168	1.68	4.6					205	-.030
160	10	768.5	1.7	.1	.310	7.72		12.29	.178	1.78	4.3					203	-.030
165	15	768.4	1.6	.1	.307	7.64		12.34	.185	1.84	4.2					202	-.030
170	20	768.4	1.6	0	.298	7.42		12.55	.188	1.87	4.0					200	-.030
175	25	768.3	1.5	.1	.291	7.25		12.66	.199	1.98	3.7					198	-.030
Tot																2541	.392

Time E/t	Time ⏲	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2^{nd} burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	Tube 2 #19	Tube 3 #20
120	1230	578	502	381	477	300	800	1042	78	95	224	34	81	36	1277			
125	35	493	492	377	470	299	791	971	78	95	220	34	82	37	1151			
130	40	485	488	375	467	299	783	928	78	95	218	34	81	36	1011	ΔT	422.8	-9.4
135	45	468	478	380	460	299	773	915	78	94	220	34	82	37	990			
140	50	458	470	383	455	298	763	899	78	94	222	34	81	36	968			
145	55	444	462	383	448	298	754	885	77	93	223	35	82	37	953		407.0	-15.8
150	1300	436	457	382	446	297	743	868	78	93	220	35	81	36	928			
155	05	424	457	380	437	297	737	859	77	93	220	34	81	36	923			
160	10	422	448	379	436	297	733	852	78	93	219	35	81	37	911			
165	15	415	443	378	432	297	725	842	77	92	218	35	82	37	899		393.0	-39.2
170	20	411	438	376	430	296	716	833	78	92	217	34	81	37	883			
175	25	405	435	375	428	297	709	816	78	93	217	35	82	37	864			
Tot		5379	5564	4549	5386	3574	9027	10710	933									

Myren C[illegible]sulting Inc Data Sheet P4 of 5 Unit Kuma A-hwood Date 2/20/09 Run FPA 5
Test En[illegible]t. 766.8 ΔT 432.2 Barometric Pressure 28.5 "hg Gas Flows @ 1.5" Technician(s) ATM JR PDG

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
180	1330	768.2	1.4	.1	.290	7.22		12.64	2.09	2.08	3.5					196	-.029
185	35	768.1	1.3	.1	.293	7.30		12.60	.201	2.00	3.6					194	-.027
190	40	768.1	1.3	0	.292	7.27		12.61	.204	2.03	3.6					193	-.027
195	45	768.0	1.2	.1	.282	7.02		12.82	.213	2.12	3.3					192	-.027
200	50	767.9	1.1	.1	.284	7.07		12.74	.219	2.18	3.2					190	-.027
205	55	767.8	1.0	.1	.276	6.88		12.96	.214	2.13	3.2					189	-.026
210	1400	767.7	.9	.1	.272	6.78		12.99	.228	2.27	3.0					188	-.026
215	05	767.7	.9	0	.268	6.68		13.10	.226	2.25	3.0					187	-.026
220	10	767.6	.8	.1	.271	6.75		13.00	.231	2.30	2.9					186	-.025
225	15	767.5	.7	.1	.260	6.48		13.21	.243	2.42	2.7					184	-.025
230	20	767.5	.7	0	.256	6.38		13.26	.250	2.50	2.6					183	-.025
235	25	767.4	.6	.1	.254	6.33		13.28	.258	2.57	2.5					182	-.025
Tot																2264	.315

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2^{nd} burn #10	Amb. #11	Tnl. #12	C Gas. H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Cent. 2nd #17	Tube 1 #18	~~Tube 2~~ ΔT #19	Tube 3 ΔΔT #20
180	1330	400	432	373	424	296	702	805	79	94	217	34	82	37	847		385.0	-47.2
185	35	394	430	371	420	296	697	794	79	95	216	35	83	37	844			
190	40	390	428	369	417	296	691	797	80	95	216	35	84	37	833			
195	45	385	425	365	413	296	685	793	80	96	218	35	85	37	830			
200	50	382	424	361	411	295	681	781	80	95	220	35	85	37	819			
205	55	377	421	356	408	294	676	770	81	95	221	35	85	37	810		371.2	-61.0
210	1400	375	419	353	405	294	671	762	81	95	222	35	85	37	801			
215	05	372	417	352	403	294	666	756	81	95	223	35	86	37	798			
220	10	367	414	351	399	293	663	750	82	96	224	35	86	37	787			
225	15	364	411	352	396	291	655	742	82	97	224	35	86	37	780			
230	20	361	409	351	394	291	650	734	82	98	223	35	87	37	773			
235	25	358	407	351	391	291	643	724	82	98	222	35	88	38	767		359.6	-72.6
Tot		4525	5037	4305	4881	3527	8080	9208	969									

Myren Consulting Inc Data Sheet P5 of 5 Unit Kuma A wood Date 2/20/09 Run PA5

Test End Wt 766.8 ΔT 432.2 Barometric Pressure 28.5 "hg Gas Flows @ 1.5" Technician(s) ATM JRP PDG

Time E/T min	Time (clock)	Scale Wt.	Lbs. Left	Burn Rate	CO_2 v.	CO_2 %	O_2 v.	O_2 %	CO v.	CO %	Gas Bal	Opacity & Notes	Calc Wet B	Wet B #1	Dry B #2	Stack Temp #3	Stack Static Press
240	1430	767.3	.5	.1	.252	6.28		13.39	.246	2.46	2.6						
245	35	767.3	.5	0	.250	6.24		13.44	.247	2.46	2.5					181	-.025
250	40	767.2	.4	.1	.251	6.26		13.40	.248	2.48	2.5					180	-.025
255	45	767.1	.3	.1	.266	6.63		13.40	.175	1.75	3.8					179	-.024
260	50	767.1	.3	0	.266	6.63		13.37	.180	1.80	3.7					178	-.024
265	55	767.0	.2	.1	.269	6.70		13.19	.202	2.01	3.3					178	-.024
270	1500	766.9	.1	.1	.270	6.73		13.11	.214	2.13	3.2					178	-.024
275	05	766.8	0	.1	.266	6.63		13.17	.220	2.20	3.0					178	-.024
280																178	-.024
285													Total			1430	-.194
290													AVG ÷		56	13346	2.074
295																238	-.037
Tot																	

Time E/t	Time (clock)	Top #4	Left #5	Back #6	Right #7	Bottom #8	Firebox #9	2nd burn #10	Amb. #11	Tnl. #12	C Gas H Box #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	Tube 1 #17	Tube 2 #18	~~Tube 3~~ ΔT #19	~~H2O Hbox~~ ΔΔT #20
240	1430	355	404	352	388	290	639	722	83	97	222	35	88	37	764			
245	35	352	401	352	386	289	634	713	82	97	221	35	88	38	756			
250	40	350	399	350	384	289	625	710	81	97	221	35	88	37	764			
255	45	348	397	348	382	287	624	739	82	96	220	35	87	38	796			
260	50	347	395	347	380	287	622	742	82	95	220	35	86	37	799			
265	55	347	393	346	379	286	620	743	81	95	219	35	86	38	808			
270	1500	347	391	346	378	284	617	738	81	94	218	35	85	37	790			
275	05	346	389	345	378	283	613	734	81	94	218	35	85	38	787		348.2	-84.0
280		2792	3169	2786	3055	2295	4994	5841	653									
285		27355	25178	19262	24337	17163	40954	54364	4405	Total								
290		488	450	344	435	306	731	971	79	AVG	÷56				Delta T			
295															Start	432.2		
Tot															Stop	348.2		
															ΔΔT	-84.0		

WST6-Form8 Rev 5/96

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-1

Site: Myren Consulting, Colville [redacted], WA Date: 2/20/09 Analyte: CO_2

Source: Kuma Ashwood Run #: EPA 5

Zero Cyl #: TC 3AAM154 Conc. 00.0 % CO_2 Cyl Press: 1470 psi

Certified by: Oxarc Date: 11/12/07

Span Cyl #: AS 90457 Conc. 12.5 % CO_2 Cyl Press: 1450 psi

Certified by: Matheson Tri Gas Date: 2/2/09

Analyzer: Make: Horiba Model: PIR-2000 SN: 607024

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

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter: ____

EPA Span Value = 25.0% CO_2
EPA Control Limits = + 2.5% of 25.0% CO_2 = + 0.625% CO_2

Pre Run Audit: By: A.T. Myren Time: 928 Temp: 78 °F

Audit Results

Point #	Expected Response Meter	Expected Response DVM	Expected Response %	Actual Response Meter	Actual Response DVM	Actual Response %	± Conc. Difference	Δ %
Zero	00.0	.000	00.0	00.0	.000	.05453	+0.05453	+0.22
Span	50.0	.500	12.5	49.75	.499	12.38575	-0.11425	-0.91

Comments:

Post Run Audit: By: A.T. Myren Time: 1600 Temp: 80 °F

Audit Results

Point #	Expected Response Meter	Expected Response DVM	Expected Response %	Actual Response Meter	Actual Response DVM	Actual Response %	± Conc Difference	Δ %
Zero	00.0	.000	00.0	000	.001	.07925	+0.07925	+0.32
Span	50.0	.500	12.5	49.5	.499	12.38575	-0.11425	-0.91

Comments:

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

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

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Exp \% (ppm)}}$ X 100

PRE AND POST TEST ZERO/SPAN CHECK
WOODSTOVE DATA SHEET #15-3

Site: Myren Consulting, ~~Woodinville~~ Colville, WA Date: 2/20/09 Analyte: CO

Source: Kuma Ashwood Run #: EPA 5

Zero Cyl #: TC3AAM 184 Conc. 00.0 % CO Cyl Press: 1500 psi

Certified by: Oxarc Date: 11/12/07

Span Cyl #: " Conc. 2.00 % CO Cyl Press: 1450 psi

Certified by: Matheson TriGas Date:

Analyzer: Make: [redacted] HORIBA Model: [redacted] Mexa 311GE SN: [redacted] GE-30075

Range: 0 - 10.0% CO Analyzer Output: 0 - [redacted] 1.0 V [redacted].

Flow: 1.5 SCFH Measured by: Rotameter: X Flowmeter:

EPA Span Value = 5.0% CO
EPA Control Limits = ±2.5% of 5.0% CO = ± 0.125% CO

Pre Run Audit: By: A.T. Myren Time: 9:28 Temp: 78 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	00.0	.000	-.00443	-0.00443	-0.04
Span	2.00	.200	2.00	2.00	.199	1.9959	-0.00411	-0.21

Comments:

Post Run Audit: By: A.T. Myren Time: 1600 Temp.: 80 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.00	.000	-.00443	-0.00443	-0.04
Span	2.00	.200	2.00	1.95	.195	19.5569	-0.04431	-2.22

Comments:

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

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

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

Unit Kuma Ashwood
Run EPA 5
Date 2/20/09
Technicians AJM JRP PDG
WST5-Form3-Rev11/89

QUALITY CHECKS
WOODSTOVE DATA SHEET #16

Ambient = Tr: ______ °F T/C#30: ______ °F

Thermocouple Check (at ambient): T/C#1: — °F; T/C#2: 65.8 °F;

T/C #3: 80.7 °F;	T/C #4: 93.8 °F;	T/C #5: 100.8 °F;
T/C #6: 90.8 °F;	T/C #7: 94.0 °F;	T/C #8: 105.6 °F;
T/C #9: 105.8 °F;	T/C #10: 105.2 °F;	T/C #11: 60.4 °F;
T/C #12: 64.8 °F;	T/C #13: 65.4 °F;	T/C #14: 60.1 °F;
T/C #15: 64.7 °F;	T/C #16: 55.9 °F;	T/C #17: 95.8 °F;
T/C #18: — °F;	T/C #19: ______ °F;	T/C #20: ______ °F;
T/C #21: ______ °F;	T/C #22: ______ °F;	T/C #23: ______ °F;
T/C #24: ______ °F;	T/C #25: ______ °F;	T/C #26: ______ °F;

Comments: ______

Thermocouple Readout: Pretest Zero/Span Check and Calibration:

Zero (0°F): 0.4 °F	Adj to: — °F	Post Test Check Zero (0°F): 1.0 °F	% Difference +0.02
Span (2000°F): 2000.5 °F	Adj to: — °F	Span (2000°F): 2002.5 °F	+0.10

(Allowable % Difference = 1.5%. Use formulas on Woodstove Data Sheet #15 to calculate % Difference) In Degrees Absolute.

Thermocouple Readout Pretest Linearity Check

0°F = 0.5 °F;	200°F = 202.1 °F;	400°F = 399.6 °F;
600°F = 601.8 °F;	800°F = 802.1 °F;	1000°F = 1001.2 °F;
1200°F = 1198.9 °F;	1400°F = 1399.9 °F;	1600°F = 1600.4 °F
1800°F = 1800.6 °F;	2000°F = 2000.5 °F	

Combustion Gas (CO_2, O_2, CO) Train Leak Check: Pre OK JRP Post OK PDG

Draft (Static) Guage Zero Check: Pre ~~OK~~ Post OK JRP

Scale Check Pre (Wt, #'s): 769.9 − 764.9 = 5.0 lbs / 5.0 lbs = Ok AJM

Post (Wt, #'s): 766.7 − 771.7 = 5.0 lbs / 5.0 lbs = Ok AJM PDG

Stack cleaned prior to the run: Yes ______ No ✓

Tunnel cleaned prior to the run: Yes ______ No ✓

Becherini Scale Center, Inc.
317 E. Sprague
Spokane, WA. 99202

SCALE CALIBRATION RECORD

CUSTOMER: Myren Consultants

DATE: 12-8-97

WORK ORDER NO.:

PO NUMBER:

EQUIPMENT MFG	SERIAL NUMBER	SPECIFICATIONS	WEIGHT USED	INITIAL READINGS	FINAL READINGS
) Panther	4466459	1000 x .1 lb	Ø	Ø	
	(PASS)........FAIL		100.0	100.0	
NOTES: 0.0 = 0.0, 50.0 = 50.0, 100.0 = 100.0, 200.0 = 200.0, 300.0 = 300.0, 400.0 = 400.0, 500.0 = 500.0, 600.0 = 600.0, 650.0 = 650.0			500.0	500.0	
			1000.0	1000.0	
			Ø	0	
			XXXXX	XXXXXX	XXXXX
)					
	PASS........FAIL				
NOTES:					

ADDITIONAL COMMENTS:

LAST CHECKED:

NEXT CHECK DUE: 6-98

WEIGHTS CERTIFIED: 6-96

TECHNICIAN: Paul [signature]

Calibration checked IAW NIST handbook 44

QUALITY CONTROL SERVICES
LABORATORY AND METROLOGY EQUIPMENT: SALES AND SERVICE
2340 S.E. 11th Avenue • Portland, Oregon 97214
P.O. Box 14831 • Portland, Oregon 97293 • (503) 236-2712 • FAX: (503) 235-2535
Established 1974

Myren Consulting
512 Williams Lake Road
Colville, WA 99114

CERTIFICATE OF SERVICE AND CALIBRATION

The measurement and test equipment initialed and dated on the QCS Report of Service and Calibration #29683 has been serviced and calibrated by Quality Control Services using test standards that are traceable to the National Institute of Standards and Technology (N.I.S.T.) through QCS master standard #1550.01. Unless otherwise noted in the comments section of the report, all measurement and test equipment meets or exceeds customer calibration tolerances.

Technician Signature: ____________________ **Date:** 11/14/08

Technician Signature: ____________________ **Date:** ____________

PTID: MYRC02

Quality Control Services

Report of Services and Calibration

2340 S.E. 11TH AVENUE
PORTLAND, OR 97214
PHONE 503-236-2712

29683

Sold To	Myren Consulting PT ID: MYRC02	P.O. No:	Onsite
Address	512 Williams Lake Road	Contact:	Mr. Ben Myren
City	Colville. WA 99114	Phone:	509-685-9458
Ship To	512 Williams Lake Road Colville, WA 99114	Email:	bmyren@pcix.com

No	Item	Make	Model	Serial Number	Location	Contact	Rate	Date Svc'd	Tech	Rec'd By
1	Balance	Sartorius	CP224S	17050374	Lab	Ben Myren	$115.00	11/14/[illegible]	R	
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										

Service / Calibration Documentation Requirements

- [x] Certificate of Calibration
- [ ] Calibration with Data
- [ ] A2LA Certificate

Received By: [illegible signature] Date: [illegible]

Comments:

PARTS

No.	Description	Part #	Qty.	@	Amt.	No.	Description	Part #	Qty.	@	Amt.

Established 1974

QUALITY CONTROL SERVICES

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

Date: 08/04/2004
Report Number: MYRCO 040804

Customer
Myren Consulting
512 Williams Lake Road
Colville, WA. 99114
Ben Myren

CERTIFICATE OF CALIBRATION

THE INSTRUMENTS LISTED BELOW HAVE BEEN SERVICED AND CALIBRATED BY QUALITY CONTROL SERVICES ON THE DATE INDICATED. SERVICE CONSISTS OF ACCURACY TESTS, ADJUSTING TO MANUFACTURER OR CUSTOMER SPECIFICATIONS AND COMPLETE CALIBRATION WITH STANDARDS TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (N.I.S.T.).

Item	Make	Model	Serial Number	Location	Contact	Cal. Date	Cal. Date Due
Balance	Sartorius	QC35EDE-S	16507622	N/A	Ben Myren	07/19/2004	07/2005

STANDARDS USED FOR THIS CALIBRATION:

Item:	Make:	Model:	Serial Number	NIST ID:	Cal. Date:	Cal. Due:
1mg-5kg	Rice Lake	1mg to 5kg	2004W	822/265349-01	08/20/2003	08/2004

Technician: D.Wright D. Wright
Signature

Form Number: GC01 Customer Code: MYRCO Rev. Date: 05/13/2003

QUALITY CONTROL SERVICES

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

tablished 1974

ʼIyren Consulting
12 Williams Lake Road
ʼolville, WA 99114

CERTIFICATE OF CALIBRATION

Certificate Date: 4/6/08

The instruments listed below have been serviced and calibrated by Quality Control Services on the date indicated. Service consists of accuracy tests, adjusting to manufacturer or customer specifications and complete calibration with standards traceable to the National Institute of Standards(NIST).

Item	Make Model	Serial Number Customer's ID	Location	Contact	Calibration Date	Calibration Due Date
Balance	Sartorius CP224S	17050374	Lab	Ben Myren	4/1/08	10/2008

STANDARDS

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

echnician: D. Deleasa

Signature: D. Deleasa

ʼID: MYRC02

DENSITY STANDARD USED FOR TROEMNER PRECISION WEIGHTS

Troemner Inc. adjusts all new weights and all weights received for recalibration on the basis of apparent mass versus material of density 8.0g/cm³ at 20°C. This action is in accordance with the recommendations of the American Society for Testing and Materials specification ANSI/ASTM E 617 and the International Organization of Legal Metrology (OIML) International Recommendation No. 20.

Previously, all weights had usually been adjusted on the basis of apparent mass versus "brass," a hypothetic material of defined density 8.4g/cm³ at 0°C and 8.3909g/cm³ at 20°C. This practice originated in the early 1800's and was adopted in all of the English speaking countries as well as a number of other countries. Now most mass standards and test weights are made from stainless steel (density ranges from 7.77g/cm³ to 8.0g/cm³). A number of countries have adopted the recommendations of OIML and the foremost balance manufacturers are adjusting the built-in weights in their balances on the basis of apparent mass versus 8.0g/cm³. In order to smooth the transition in this country, the Reports of Calibration of the National Bureau of Standards are reporting the corrections to calibrated mass standards on both bases.

In terms of normal weighing procedures the change is very small. For a given weight, the mass value assigned on the basis of apparent mass versus density 8.0g/cm³ material will be 7 parts per million higher than the value assigned on the basis of apparent mass versus "density 8.4g/cm³" material. In many cases the allowed weight adjustment tolerances are so large that this change is immaterial although closely adjusted weights often have a smaller tolerance than the correction change. For example at the 1 kilogram level the change is 7 mg. For comparison the ANSI/ASTM E 617 Class 6 tolerance for 1 kilogram is 100 mg while the Class 1 tolerance is 2.5 mg. A detailed discussion of mass and mass values is given in Reference 3.

Precision Weights manufactured by Troemner Inc. to ASTM Class 1, 1.1, 2, 3, 4, 5, and 6 tolerances and the equivalent OIML and NBS tolerances are of the following materials:

Designation	*Base Material*	*Density*	*Weight Range*
Stainless Steel	18-8	7.84g/cm³ at 20°C	1 g & larger
Stainless Steel	18-8	8.0g/cm³ at 20°C	50 mg to 500 mg
Aluminum	1100	2.7g/cm³ at 20°C	30 mg & smaller

References:

1. ANSI/ASTM E 617
   Available from: Troemner Inc. 6825 Greenway Ave., Phila. Pa. 19142 215-724-0800 or American Society for Testing and Materials, 1916 Race Street, Phila., Pa. 19103

2. OIML INTERNATIONAL RECOMMENDATION No. 20
   Available from: Organisation Internationale De Metrologie Legale 11 Rue Trugot - 75009 Paris, France

3. NBS MONOGRAPH 133, MASS AND MASS VALUES
   Available from: Superintendent of Documents, U.S. Government Printing Office Washington, D.C. 20402 Order by SD Catalog No. C13,44:1331 Stock Number 0303-01178

TROEMNER INC.

Manufacturers of Precision Weights...
Mass Standards • Balances • Laboratory Apparatus
6825 Greenway Avenue - Philadelphia, Pa. 19142
215/724-0800

Wts. USED for Scale QC Checks, P. 4-4.

M N CONSULTING, INC.
512 Williams Lake Road
Colville, WA 99114
Office: 509 684 1154
Lab: 509 685 9458

Calibration Data Sheet # 66
Revision 1 8/25/08

THERMOCOUPLE CALIBRATION

DATE: 11/9/08
TECHNICIAN: A.T. Myren

T/C #	Location	Ice Water Bath (° F)	Boiling Water (° F)
1.	Wet Bulb	33	209
2.	Dry Bulb	33	209
3.	Stack	34	209
4.	Stove Top	33	208
5.	Left Side	33	209
6.	Back	33	208
7.	Right Side	34	209
8.	Bottom	33	209
9.	Firebox	34	209
10.	2nd Burn/ Cat	34	209
11.	Ambient	33	209
12.	Tunnel	34	209
13.	C Gas Hot Box	34	209
14.	C Gas Impinger Exit	34	209
15.	Particulate Filter #1	33	208
16	Condenser #1	33	209
17.	Particulate Filter #2	33	208
18.	Condenser #2	34	208
19.	Extra	33	208
20.	Extra	33	208
21.	Extra	34	208

Thermocouples checked against

Reference Thermometer #: ERTCO CAT 1005-3FC CAT 517 SN1697
Ice Water Bath: 32.5 °F
Boiling Water: 208.9 °F
Room Temp: 63 °F
BP: 28.17 " Hg

ALTEK

CERTIFICATE OF CALIBRATION

This is to Certify that your Altek Unit has been calibrated using standards whose accuracies are traceable to the National Institute of Standards and Technology (formerly NBS) within the limits of the NIST Calibration Services. Actual records pertaining to these standards are on file and are available for examination.

Certified by: Altek Industries Corp.
Recommend Recalibration: Annually

In service date 4/11/96

Serial # 177533

Model K2100F Serial No. ____

T. Kriech
Calibration Technician

31 AUG. 95
Factory Calibration Date

ALTEK INDUSTRIES CORP.
210 Commerce Drive, Rochester, NY 14623 U.S.A.
(716) 334-3720 FAX (716) 334-6673
800-32-ALTEK
800-322-5835
Anywhere in USA

MYREN CONSULTING, INC.
512 Williams Lake Road
Colville, WA 99114
Office: 509 684 1154
Lab: 509 685 9458

Calibration Data Sheet # 65
Revision 1 3/3/04

THERMOCOUPLE READOUT CALIBRATION

DATE: 11/9/08
TECHNICIAN: A.T. Myren

Thermocouple Readout Manufacturer: Omega

Model #: 4108-K Serial #: 99110582 Type: K Range: 0-2000°F

Location: Dial #1 T/C Readout

Calibrated with: Altec

As found: 0° F = -0.6 Adjusted to: 0.00
2000° F = 1999.1 Adjusted to: 2000.0

		% Dif			% Dif			% Dif
0 =	0.0	0.0	800 =	801.0	+0.08	1600 =	1599.3	-0.03
100 =	99.7	+0.05	900 =	899.5	-0.04	1700 =	1698.5	-0.07
200 =	201.1	+0.17	1000 =	1000.2	+0.01	1800 =	1799.2	-0.04
300 =	299.6	-0.05	1100 =	1099.5	-0.03	1900 =	1899.6	+0.02
400 =	398.6	-0.16	1200 =	1197.8	-0.13	2000 =	2000.0	0.0
500 =	499.7	-0.03	1300 =	1298.9	-0.06	=		
600 =	600.8	+0.08	1400 =	1398.7	-0.07			
700 =	699.6	-0.03	1500 =	1499.2	-0.04			

$$\% \text{ Dif} = \frac{(\text{Reference Temperature }^\circ F + 460) - (\text{Readout Temperature }^\circ F + 460)}{\text{Reference Temperature }^\circ F + 460}$$

Or

$$\% \text{ Dif} = \frac{(\text{Reference Temperature }^\circ C + 273) - (\text{Readout Temperature }^\circ C + 273)}{\text{Reference Temperature }^\circ C + 273}$$

EN CONSULTING, INC.
512 Williams Lake Road
Colville, WA 99114
Office: 509 684 1154
Lab: 509 685 9458

Calibration Data Sheet # 65
Revision 1 3/3/04

THERMOCOUPLE READOUT CALIBRATION

DATE: 11/19/08
TECHNICIAN: [illegible]

Thermocouple Readout Manufacturer: Omega

Model #: 115KF Serial #: 4487K7 Type: K Range: 0-1900°F

Location: 450-P Meter Box

Calibrated with: Altec

As found: 0° F = 000 Adjusted to: –
1900° F = 1896 Adjusted to: –

		% Dif			% Dif			% Dif
0 =	0	0	800 =	798	-0.16	1600 =	1598	-0.10
=	96	-0.71	900 =	897	-0.22	1700 =	1698	-0.09
200 =	202	+0.30	1000 =	999	-0.07	1800 =	1797	-0.14
300 =	298	-0.26	1100 =	1097	-0.19	1900 =	1897	-0.13
400 =	399	-0.12	1200 =	1198	-0.12	2000 =	–	
500 =	498	-0.21	1300 =	1297	-0.17	=		
600 =	599	-0.09	1400 =	1398	-0.11			
700 =	696	-0.34	1500 =	1497	-0.15			

$$\% \text{ Dif} = \frac{(\text{Reference Temperature }^{\circ}F + 460) - (\text{Readout Temperature }^{\circ}F + 460)}{\text{Reference Temperature }^{\circ}F + 460}$$

Or

$$\% \text{ Dif} = \frac{(\text{Reference Temperature }^{\circ}C + 273) - (\text{Readout Temperature }^{\circ}C + 273)}{\text{Reference Temperature }^{\circ}C + 273}$$

Woodstove Data Sheet # 55
Revision 0 12/18/01

THERMOMETER CALIBRATION DATE: 11/9/08 TECHNICIAN: A.T. Myrum

MANUFACTURER:	Ertco	Ertco	Fisher	Taylor	Taylor	Premium	
CAT #.	1005-3FC	517	ASTM-59F	1330 N/A	1330 N/A	—	
SERIAL NO.	1697	KB5-163	AD 1544	WB	DB	—	
RANGE:	-1 to 101°C	0-260°C	0-180°F	20-120°F	20-120°F	0-220°F	
GRADUATIONS:	0.1°C	1.0°C	1°F	1°F	1°F	2°F	
TYPE:	Tube	Tube	Tube	Tube	Tube	Dial	
TEMP. POINT 1	1.1	1.0	33	33	33	35	
2	7.2	8.0	46	46	47	49	
3	15.6	16.0	61	62	62	64	
4	37	38	100	100	100	104	

COMMENTS:

$°F = (°C \times 9/5) + 32$
$°C = (5/9)(°F - 32)$

R E P O R T O F C A L I B R A T I O N

LIQUID-IN-GLASS-THERMOMETER

THE THERMOMETER WAS TESTED IN A LARGE, CLOSED-TOP, ELECTRICALLY HEATED, LIQUID BATH, BEING "IMMERSED" 76MM. THE TEMPERATURE OF THE ROOM WAS ABOUT 25 DEGREES C (77 DEGREES F). IF THE THERMOMETER IS USED UNDER CONDITIONS WHICH WOULD CAUSE THE AVERAGE TEMPERATURE OF THE EMERGENT LIQUID COLUMN TO DIFFER MARKEDLY FROM THAT PREVAILING IN THE TEST, APPRECIABLE DIFFERENCES IN THE INDICATIONS OF THE THERMOMETER WOULD RESULT.

THE TABULATED CORRECTIONS APPLY PROVIDED THE ICE-POINT READING, TAKEN AFTER EXPOSURE FOR NOT LESS THAN 3 DAYS TO A TEMPERATURE OF ABOUT 20 DEGREES C (70 DEGREES F) IS 0.00 DEGREES C. IF THE ICE-POINT READING IS FOUND TO BE HIGHER (OR LOWER) THAN STATED, ALL OTHER READINGS WILL BE HIGHER (OR LOWER) TO THE SAME EXTENT. IF THE THERMOMETER IS USED AT A GIVEN TEMPERATURE SHORTLY AFTER BEING HEATED TO A HIGHER TEMPERATURE. AN ERROR OF 0.01 DEGREES OR LESS, FOR EACH 10 DEGREE DIFFERENCE BETWEEN THE TWO TEMPERATURES, MAY BE INTRODUCED. THE TABULATED CORRECTIONS APPLY IF THE THERMOMETER IS USED IN THE UPRIGHT POSITION; IF USED IN A HORIZONTAL POSITION, THE INDICATIONS MAY BE A FEW HUNDREDTHS OF A DEGREE HIGHER.

TEST NUMBER: 152439
DATE: 07/16/96
STANDARD SERIAL NO. 128239
[illegible]T IDENTIFICATION NO. 88024

C. [signature]

Charles Tang-Nian
QUALITY CONTROL MANAGER

EVER READY THERMOMETER CO., INC.
228 LACKAWANNA AVENUE
WEST PATTERSON, NJ 07424
(201) 812-7474

R E P O R T   O F   C A L I B R A T I O N

LIQUID-IN-GLASS-THERMOMETER

CALIBRATED BY EVER READY THERMOMETER CO.

MARKED: ERTCO CAT 1005-3FC S/N-1697
RANGE: -1 TO +101 DEGREES C IN 0.1 DEGREE GRADUATIONS.

THERMOMETER READING	CORRECTION (ITS-90)**
0.00 C	0.00 C
10.00	0.00
20.00	0.00
30.00	0.00
37.00	0.00
40.00	0.00
50.00	0.00
56.00	0.00
60.00	0.02
70.00	0.00
80.00	0.00
90.00	0.00
100.00	0.00

** ALL TEMPERATURES IN THIS REPORT ARE BASED ON THE INTERNATIONAL TEMPERATURE SCALE OF 1990 (ITS-90) PUBLISHED IN THE METROLGIA 27, NO. 1, 3/10/90.

THIS THERMOMETER WAS CALIBRATED AGAINST A STANDARD CALIBRATED AT THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) FORMERLY THE NATIONAL BUREAU OF STANDARDS (NBS) IN ACCORDANCE WITH ASTM METHOD E 77, AND NBS MONOGRAPH 174.

FOR A DISCUSSION OF ACCURACIES ATTAINABLE WITH SUCH THERMOMETERS SEE NBS MONOGRAPH 250-23.

IF NO SIGN IS GIVEN ON THE CORRECTION, THE TRUE TEMPERATURE IS HIGHER THAN THE INDICATED TEMPERATURE; IF THE SIGN GIVEN IS NEGATIVE, THE TRUE TEMPERATURE IS LOWER THAN THE INDICATED TEMPERATURE. TO USE THE CORRECTIONS PROPERLY, REFERENCE SHOULD BE MADE TO THE NOTES GIVEN BELOW.

CONTINUED

TEST NUMBER: 152439
DATE: 07/16/96
STANDARD SERIAL NO. 128239
NIST IDENTIFICATION NO. 88024

CFM
TM ,000

DRY GAS METER CALIBRATION DATA

Date 11/9/08 Calibration Meter # 1052202 Console Leak Check Front DGM ,003

Y = ,9978 Back ,000"H2O/MIN

Meter Box # 45G-P Barometric Pressure, Bp = 28.16"Hg Pitot Leak Check N/A

Calibrated by A.T. Myrl Dry Gas Meter # 2039270 Electrical Check Ok

Orifice (dH) in. H20		Gas Volume: Cal. Meter (Vc), cu.ft.	Gas Volume: Dry Gas Meter (Vm), cu.ft.		Temperature: Cal. Meter (Tc), F	Temperature: Dry Gas Meter Inlet (Tmi), F	Temperature: Dry Gas Meter Outlet (Tmo), F	Time (0), min.	VAC
.80									
.80	init.	504.671	759.000	init.	66 65	67 71	67 71	18:01.31	0
.80	final	513.504	767.851	final	63 63 63 63	73	73	18.022	0
.80 / .8	total	8.833	8.851	avg.	63.8		70.3		0
					523.8		530.3		
.90									
.90	init.	514.159	768.500	init.	63 63	73 76	74 76	11:05.86	0
.90	final	520.190	774.570	final	62 62 62 62	78	76	11.098	0
.90 / .9	total	6.031	6.070	avg.	62.3		75.8		0
					522.3		535.8		
1.00									
1.00	init.	520.811	775.200	init.	62 63 62 62	78 80	78 80	14:34.09	0
1.00	final	528.9275	783.398	final	62 62	82	82	14.568	0
1.00 / 1.00	total	8.1165	8.198	avg.	62.2		80		0
					522.2		540		0
1.50									
1.50	init.	530.118	784.600	init.	62 62	82	82	11:19.84	0
1.50	final	537.846	792.414	final	62 62	84	84	11.332	0
1.50	total	7.728	7.814	avg.	62		83		
					522		543		
2.00									
2.0	init.	538.824	793.400	init.	63 62	84	84	9:19.50	0
2.05	final	546.1605	800.803	final	62 62	86	86	9.325	0
2.025	total	7.3365	7.403	avg.	62.25		85		
					522.25		545		

$$Y = \frac{Y\ Vc\ Pb(Tm + 460)}{Vd(Pb + dH/13.6)\ (Tc + 460)}$$

$$dH@ = \frac{0.0317\ dH}{Pb(Tmo + 460)} [(Tc + 460)\ \theta/Vc]^2$$

$$Y = \frac{(Y_d)(V_c)(Pb)(T_m + 460)}{(V_d)(Pb + \Delta H/13.6)(T_c + 460)} =$$

$$Y = \frac{(0.9978)(8.833)(28.16)(\overset{530.3}{70.3} + 460)}{(8.851)(28.16 + .80/13.6)(\underset{523.8}{63.8} + 460)} = \frac{131,615.188}{130,826.059} = 1.00603$$

$$Y = \frac{(.9978)(6.081)(28.16)(\overset{535.8}{75.8} + 460)}{(6.070)(28.16 + .90/13.6)(\underset{522.3}{62.3} + 460)} = \frac{90,796.308}{89,487.169} = 1.01463$$

$$Y = \frac{(.9978)(8.1165)(28.16)(\overset{540}{80} + 460)}{(8.198)(28.16 + 1.00/13.6)(\underset{522.2}{62.2} + 460)} = \frac{123,151.216}{120,867.615} = 1.01889$$

$$Y = \frac{(.9978)(7.728)(28.16)(\overset{543}{83} + 460)}{(7.814)(28.16 + 1.50/13.6)(\underset{522}{62} + 460)} = \frac{117,907.951}{115,311.929} = 1.02251$$

$$Y = \frac{(.9978)(7.3365)(28.16)(\overset{545}{85} + 460)}{(7.403)(28.16 + 2.085/13.6)(\underset{522.25}{62.25} + 460)} = \frac{112,847.024}{109,448.332} = 1.02648$$

Y FACTOR	VARIATION (± 0.02 ALLOWED FROM AVERAGE Y)
1.00603	-0.01168
1.01463	-0.00308
1.01889	+0.00118
1.02251	+0.00480
1.02648	+0.00877

Avg Y 1.01771

METER BOX 45G-P
DATE 11/9/08
Page 3 of 3

$$\Delta H@ = \frac{(0.0317)(\Delta H)}{(Pb)(T_{mo} + 460)} \cdot \left[\frac{(T_w + 460)(\Theta)}{(Y_c)(V_c)}\right]^2 =$$

$$\Delta H@ = \frac{(0.0317)(.80)}{(28.16)(70.3 + 460)} \cdot \left[\frac{(63.8 + 460)(18.022)}{(.9978)(8.833)}\right]^2 = \underline{1.94818}$$

530.3 — 523.8 — 522.3

$$\Delta H@ = \frac{(0.0317)(.90)}{(28.16)(76 + 460)} \cdot \left[\frac{(62.3 + 460)(11.098)}{(.9978)(6.031)}\right]^2 = \underline{1.75375}$$

536 — 522.2

$$\Delta H@ = \frac{(0.0317)(1.00)}{(28.16)(80 + 460)} \cdot \left[\frac{(62.2 + 460)(14.568)}{(.9978)(8.1165)}\right]^2 = \underline{1.83942}$$

540 — 522

$$\Delta H@ = \frac{(0.0317)(1.50)}{(28.16)(83 + 460)} \cdot \left[\frac{(62 + 460)(11.532)}{(.9978)(7.728)}\right]^2 = \underline{1.83000}$$

543 — 522.5

$$\Delta H@ = \frac{(0.0317)(2.025)}{(28.16)(85 + 460)} \cdot \left[\frac{(62.5 + 460)(9.325)}{(.9978)(7.3365)}\right]^2 = \underline{1.85116}$$

545

ΔH@	VARIATION (± 0.20 ALLOWED)
1.94818	+0.1037
1.75375	-0.0908
1.83942	-0.0081
1.83000	-0.0145
1.85116	+0.0067

AVG ΔH@ 1.84450

Post Test
Meter Box Audits
Woodstove Data Sheet #32

Unit: Kuma Ashwood
Date: 3/3/09
Technician: A.T. Myre
WST9-Form2,Rev12/88

METER BOX CALIBRATION AUDIT

Test Data

Run #	1	2	3	4	5	6	7	8	9	10
Avg. Δ H	0.9	0.9	0.9	0.9	0.9	0.9	0.9			
Max Vac	0	0	0	0	0	0	0			

Avg. Test Series Δ H: 0.9 in H_2O. Test Series Max Vac: 0 in Hg

Audit Dry Gas Meter: Rockwell 1052202 Correction (Y) Factor: 0.9978
Test Dry Gas Meter: 45G-P 3039270 Correction (Y) Factor: 1.0177

Audit Data

		Audit #1	Audit #2	Audit #3
BP:		28.13	28.12	28.12 "Hg
Vac:		0.0	0.0	0.0 "Hg
Audit Meter:	Final Vol	808.611	814.440	821.122
	Initial Vol	802.368	808.742	814.674
	Vol (V_w, ft^3)	6.243	5.698	6.448
Audit Meter:	Initial	64	62	62
Temp (°F)(T_w)	Mid	63	61	61
	Final	62	61	61.5
	Avg (°F/°A)	63 (523)	61.3 (521.3)	61.5 (521.5)
Δ H (in H_2O)	Initial	0.90	0.90	0.90
	Mid	0.90	0.90	0.90
	Final	0.90	0.90	0.90
	Avg	0.90	0.90	0.90
Dry Gas Meter:	Final Vol	894.764	900.653	907.445
	Initial Vol	888.500	894.900	900.900
	Vol (V_d, ft^3)	6.264	5.753	6.545
Dry Gas Meter	Initial	67	70	73
Temp (°F):Inlet	Mid	68.5	73	75
	Final	70	74	75
	Avg (°F/°A)	68.5 (528.5)	72.3 (532.3)	74.3 (534.3)
Dry Gas Meter	Initial	67	70	73
Temp (°F):Outlet	Mid	68.5	73	75
	Final	70	74	75
	Avg (°F/°A)	68.5 (528.5)	72.3 (532.3)	74.3 (534.3)
Avg Dry Gas Meter Temp (T_m-°F/°A)		68.5 (528.5)	72.3 (532.3)	74.3 (534.3)
Time (minutes)		11:44.87	10:47.03	10:16.44

$$Y = \frac{(Vw)(MCF)(BP)(Tm)}{(Vd)(BP + \frac{\Delta H}{13.6})(Tw)}$$

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

NOTE: MCF = Meter Correction (Y) Factor for Dry Gas Meter used as a Transfer Standard

Run 1

$$Y = \frac{(6.243)(.9978)(28.13)(528.5)}{(6.264)(28.13 + \frac{0.90}{13.6})(523)} = \frac{92,608.651}{92,372.704} = 1.00255$$

$$\Delta\% = \frac{(1.00255 - 1.01463)}{1.01463} \times 100 = -1.191\ \%$$

Run 2

$$Y = \frac{(5.698)(.9978)(28.12)(532.3)}{(5.723)(28.12 + \frac{0.90}{13.6})(521.8)} = \frac{85,101.600}{84,531.440} = 1.00675$$

$$\Delta\% = \frac{(1.00675 - 1.01463)}{1.01463} \times 100 = -0.777\ \%$$

Run 3

$$Y = \frac{(6.448)(.9978)(28.12)(534.3)}{(6.545)(28.12 + \frac{0.90}{13.6})(521.5)} = \frac{96,664.947}{96,205.551} = 1.00478$$

$$\Delta\% = \frac{(1.00478 - 1.01463)}{1.01463} \times 100 = -0.971\ \%$$

NOTE: The Y Factor % Difference must be < ±5.0% to be acceptable

Determination of Interpolated Y Factor for Average Certification Test Series Delta H from Dry Gas Meter Calibration Data:

$\bar{X} = -0.980$

0.90 (A) inch H_2O Delta H = 1.01463 (C) Calculated Calibration Y Factor (from Calibrations)

____ (B) inch H_2O Delta H = ____ (D) Calculated Calibration Y Factor (from Calibrations)

____ (B) - ____ (A) = ____ X 100 = ____ (E)

____ (D) - ____ (C) = ____ ÷ ____ (E) = ____ (F)

____ Avg Delta H - ____ (A) = ____ X 100 = ____ (G)

[____ F X ____ G] + ____ C = ____ Interpolated Y Factor For Avg. Test Series Delta H

Volume Metering System Leak Check: ____ inch H_2O in one minute

S-110-1052202 Myre J Inc 38987.xls

APEX INSTRUMENTS REFERENCE METER VERIFICATION
USING WET-TEST METER #11AE6
2-POINT ENGLISH UNITS

Calibration Meter Information	
Wet Test Meter Model #	AL20
Wet Test Meter Serial #	11AE6
Wet Test Meter Gamma	0.99730

Calibration Conditions			
Date	Time	6-Jan-09	1:30
Barometric Pressure		29.50	in Hg
Calibration Tech		EW	
DGM Serial Number		1052202	

Factors/Conversions		
Std Temp	528	°R
Std Press	29.92	in Hg
K_1	17.647	°R/in Hg

Calibration Data												Results		
Run Time	Metering Console						Calibration Meter					Dry Gas Meter		
												Calibration Factor		Flowrate
Elapsed	DGM Input Pressure	Volume Initial	Volume Final	Volume Sample	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Volume Sample	Outlet Temp Initial	Outlet Temp Final	Previous	Current	Std & Corr
(Θ)	(P_o)	(V_{mi})	(V_{mf})	(V_m)	(t_{mi})	(t_{mf})	(V_{wi})	(V_{wf})	(V_w)	(t_{wi})	(t_{wf})	(Y)	(Y)	($Q_{m(std)(corr)}$)
min	in H_2O	cubic feet	cubic feet	cubic feet	°F	°F	cubic feet	cubic feet	cubic feet	°F	°F			cfm
6.00	-3.5	701.310	707.150	5.840	78.8	80.6	273.560	279.330	5.770	71	71	1.0067	1.0130	0.943
											Variation	0.6297	must be less than 1.5%	
10.00	-2.2	707.150	712.489	5.339	80.6	82.4	279.330	284.610	5.280	71	71	1.0084	1.0141	0.518
											Variation	0.5618	must be less than 1.5%	

I certify that the above Dry Gas Meter was calibrated in accordance with USEPA Methods, CFR 40 Part 60, App A, Method 5, Paragraph 7.1.2.2, using the Precision Wet Test Meter # 11AE6, which in turn was calibrated using the American Bell Prover # 3785, certificate # F107, which is traceable to the National Bureau of Standards (N.I.S.T.).

Signature Ew Date 1/6/09

S110-1052202 isulting 33359

APEX INSTRUMENTS REFERENCE METER CALIBRATION
USING WET-TEST METER #11AE6
15-POINT ENGLISH UNITS

Calibration Meter Information	
Wet Test Meter Model #	AL 20
Wet Test Meter Serial #	11AE6
Wet Test Meter Gamma	1.00190

Calibration Conditions			
Date	Time	3-Dec-07	11:00
Barometric Pressure		29.6	in Hg
Calibration Technician		EW	
DGM Serial Number		1052202	

Factors/Conversions		
Std Temp	528	°R
Std Press	29.92	in Hg
K_1	17.647	°R/in Hg

Calibration Data										Results		
Run Time	Dry Gas Meter					Calibration Meter				Dry Gas Meter		
										Calibration Factor		Flowrate
Elapsed	Meter Pressure	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Value	Variation	Std & Corr
(Θ)	(P_m)	(V_m)	(V_m)	(t_m)	(t_m)	(V_w)	(V_w)	(t_w)	(t_w)	(Y)	(Y_{max}-Y_{min})	($Q_{m(std)(corr)}$)
min	in H_2O	cubic feet	cubic feet	°F	°F	cubic feet	cubic feet	°F	°F			cfm
5.00	5.0	496.0040	502.9400	80.6	80.6	511.210	517.980	69.0	69.0	0.9852		1.337
5.00	5.0	502.9400	509.9290	80.6	80.6	517.980	524.790	69.0	69.0	0.9835		1.345
5.00	5.0	509.9290	516.9260	78.8	80.6	524.790	531.610	69.0	69.0	0.9822	0.003	1.347
										0.9837	Averages	1.343
6.00	3.0	516.9260	523.3720	80.6	80.6	531.610	537.940	69.0	69.5	0.9956		1.041
6.00	3.0	523.3720	529.8040	78.8	80.6	537.940	544.250	69.5	69.5	0.9925		1.037
6.00	3.0	529.8040	536.2360	80.6	82.4	544.250	550.550	69.5	70.0	0.9938	0.003	1.035
										0.9940	Averages	1.038
7.00	2.0	536.2360	542.2700	80.6	80.6	550.550	556.490	70.0	70.0	0.9991		0.836
7.00	2.0	542.2700	548.3125	78.8	80.6	556.490	562.440	70.0	70.0	0.9978		0.838
7.00	2.0	548.3125	554.3620	78.8	80.6	562.440	568.390	70.0	70.0	0.9966	0.003	0.838
										0.9978	Averages	0.837
10.00	1.0	554.3620	560.6520	80.6	80.6	568.390	574.600	70.0	70.0	1.0045		0.612
10.00	1.0	560.6520	566.9260	80.6	80.6	574.600	580.800	70.0	70.0	1.0055		0.611
10.00	1.0	566.9260	573.1990	80.6	80.6	580.800	586.990	70.0	70.0	1.0040	0.001	0.610
										1.0047	Averages	0.611
15.00	0.5	475.7525	482.4970	78.8	78.8	491.160	497.840	69.0	69.0	1.0075		0.440
15.00	0.5	482.4970	489.2530	78.8	80.6	497.840	504.530	69.0	69.0	1.0090		0.440
15.00	0.5	489.2530	496.0040	80.6	80.6	504.530	511.210	69.0	69.0	1.0099	0.002	0.440
										1.0088	Averages	0.440
									Overall Average Y	**0.9978**		

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, the variation between the maximum and minimum values at each flow rate must not exceed 0.030.
Note: For the Overall Average Calibration Factor, Y, the acceptable range is between 0.95 and 1.05.

I certify that the above Dry Gas Meter was calibrated in accordance with USEPA Methods, CFR 40 Part 60, using the Precision Wet Test Meter # 11AE6, which in turn was calibrated using the American Bell Prover # 3785, certificate # F107, which is traceable to the National Bureau of Standards (N.I.S.T.).

Signature [signature] Date 12/3/07

VANEOMETER CALIBRATION

Myren Consulting used a Dwyer Model 3480 Vaneometer to measure test chamber air velocity. The manufacturer's specifications for accuracy are ± 5.0% from 0 to 100 fpm and ± 10% from 100 to the top of the scale. Myren Consulting insures that the instrument is level and clean prior taking each reading. According to EPA personnel (Westlin, RTP) no further calibration is necessary.

DRAFT GUAGE CALIBRATION

Myren Consulting used a Dwyer Model 115 AV, a -0.05 - 0.0 - 0.25" inclined red oil manometer (readability resolution ± 0.001" H_2O) 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 needs no further calibration.

The manometer is leveled and zeroed at the start of each test, checked as necessary during a run to verify that the settings have not changed and again at the end of each test run. The results of these checks are recorded on Woodstove Data Sheet #16 in each individual test.

BAROMETER CALIBRATION

Myren Consulting used a Princo Model 453 SN W14275 Mercury barometer and a Weems and Plath aneroid barometer to measure the barometric pressure (BP). The Weems and Plath barometer was calibrated daily by comparing it to the Princo and adjusting it as necessary. The Princo when calibrated following the manufacturer's instructions is a primary standard and needs no further calibration.

MOISTURE METER CALIBRATION

Myren Consulting used a Delmhorst RC-1E SN 1509 which was calibrated daily using the "Check" feature. Then the operation of the moisture meter was checked in the normal operating range used during testing 11-25% with a Delmhorst Moisture Content Standard Model MCS-1 at 12.0 and 22.0%. The results of these checks are recorded on Data Sheet #10.

The readings obtained with the moisture meter are then corrected as per the manufacturer's written instructions for temperature and species. If Delmhorst insulated pins are used one additional correction is required. See the following page for the correction table used to correct the readings if insulated pins were used.

7 - 7.3   8 - 8.4   9 - 9.50
7.5 - 7.85   8.5 - 8.95   9.5 - 10.05

10.0 - 10.6
10.5 - 11.2
11.0 - 11.7
11.5 12.3
12.0 - 12.8
12.5 - 13.3
13.0 - 13.9
13.5 - 14.4
14.0 - 14.9
14.5 - 15.4
15.0 - 15.9
15.5 - 16.5
16.0 - 17.0
16.5 - 17.5
17.0 - 18.1
17.5 - 18.6
Legal Range
18.0 - 19.2
18.5 - 19.8
19.0 - 20.3
19.5 - 20.9
20.0 - 21.4
20.5 - 22.0
21.0 - 22.6
21.5 - 23.1
22.0 - 23.7
22.5 - 24.3
23.0 - 24.9
23.5 - 25.4

24.0 - 26.0
24.5 - 26.6
25.0 - 27.2
25.5 - 27.8
26.0 - 28.4
26.5 - 29.0

27.0 - 29.6
27.5 - 30.2
28 - 30.8
28.5 - 31.4
29.0 - 32.0
29.5 - 32.6
30.0 - 33.2
30.5 - 33.8
31.0 - 34.4
31.5 - 35.0
32 -
32.5
33 -
33.5
34.0
34.5
35.0
35.5
36.0
36.5
37.0
37.5
38
38.5
39
39.5
40

26-ED ELECTRODE

OPERATING INSTRUCTIONS

The 26-E and 18-E Electrodes, fitted with insulated pins and used with any Delmhorst Moisture Detectors for Wood, are available in detecting moisture gradient in lumber or in testing dry stock that is wet on the surface.

These Electrodes, as long as they have good insulation on their shanks, measure moisture content at the tip of the pins only, that is in a layer about 3/16" thick.

Shell and core, moisture content is easily measured by driving the pins to the proper depths.

When using the Electrode, place the pins on the wood so that the current will flow parallel to the grain and drive the pins into the wood by means of the sliding hammer. Noteithe pins' penetration, and read the meter.

The Moisture Meter is calibrated for use with a 4-pin Electrode. When using a 2-pin Electrode, a small correction should be applied, as noted below, where line "A" shows meter readings, and line "B" the correct readings for the 2-pin Electrode.

A= 7	8	10	12	14	16	18	20	22
B= 7.3	8.4	10.6	12.8	14.9	17.0	19.2	21.4	23.7

When the insulation on the contact pins wears off, the above correction should be disregarded, and the electrode should not be used on lumber which may have a wet surface. Always use the L-319 insulating washer especially if surface moisture on the wood is expected. If washers are not available, do not allow the retainers to touch the surface of the wood.

DELMHORST
INSTRUMENT CO.

INDIAN LANE EAST, TOWACO, NJ 07082, TEL: 201-334-2557, FAX: 201-334-2657, CALL US TOLL FREE AT 800-222-0638

WOODSTOVE DATA SHEET #26-A

CEM GAS TRAIN RESPONSE TIME

PRE. CERTIFICATION TEST SERIES CHECK

Date	11/9/08	→	→	→	→	→					
Technicians	ATM	→	→	→	→	→					
Elapsed Time	CO_2 Conc.(V)	CO_2 Conc.(V)	CO_2 Conc.(V)	CO Conc.(V)	CO Conc.(V)	CO Conc.(V)	O_2 Conc.(V)	O_2 Conc.(V)	O_2 Conc.(V)	Conc.(V)	Conc.(V)
0 Seconds	.349	.347	.346	.163	.166	.169					
15	.349	.346	.345	.162	.165	.167					
30	.064	.065	.063	.054	.057	.060					
45	.033	.034	.032	.042	.048	.046					
60	.016	.015	.014	.014	.015	.017					
75	.009	.009	.008	.009	.010	.010					
90	.004	.003	.003	.003	.003	.003					
105	.002	.002	.002	.002	.003	.002					
120	.001	.002	.001	.002	.002	.002					
135	.001	.001	.001	.001	.002	.001					
150	.001	.001	.001	.001	.001	.001					
165	.001	.001	.001	.001	.001	.001					
180	.001	.001	.001	.001	.001	.001					
Initial Response Time (Seconds)	~25	~25 sec	~25	~30	~30	~30					
95% Response Time (Seconds)	>45 <60	>45 <60	>45 <60	>45 <60	>45 <60	>45 <60					
Analyzer Flow Rate	←	1.5 SCFH	→	←	1.5 SCFH	→					

Comments

InterMountain Ambient
P.O. Box 5106 ☐ Missoula, MT 59806 ☐ (406) 543-6174

Pre kuma Ashwood

QA WS 1/85

CO_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Site: Colville, WA Date: 2/16/09

Analyzer: Make: HORIBA Model: PIR 2000 SN: 607204

Calibration by: A.T. Myren

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter: ✓ Mass Flowmeter: ____
BP: 28.17 "Hg Instrument ID: Princo
Temp: 69 °F Instrument ID: Omega Digi

Analyzer last calibrated: 12/19/08 By: A.T. Myren

Cylinders:

1. #TC3AAM154 Concentration: 00.0 % CO_2 Cyl. Press.: 1550 psi.
   Certified by: Oxarc Date: 11/12/07
2. #AS90457 Concentration: 12.5 % CO_2 Cyl. Press.: 1480 psi.
   Certified by: Matheson Tri Gas Date: 2/2/2009
3. #250-1175 Concentration: 21.0 % CO_2 Cyl. Press.: 1490 psi.
   Certified by: Oxarc Date: 8/22/97
4. #250-1088 Concentration: 6.01 % CO_2 Cyl. Press.: 1100 psi.
   Certified by: Oxarc Date: 1/31/01

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

Flow: 1.5 SCFH Measured by: Rotameter: ✓ Mass Flowmeter: ____

Calibration Results

Point #	Cyl. #	% CO_2	Expected Meter	Expected DVM	Actual Meter	Actual DVM	Adj. Meter	Adj. DVM	% Dif.	Potentiometer Unadj.	Potentiometer Adj.	
1	1	00.0	00.0	.000	00.0	.000	—	—	+0.22	6.06	—	.0545
2	2	12.5	50.0	.500	50.5	.505	50.0	.500	-0.72	4.72	4.34	12.4105
3	3	21.0	84.0	.840	85.0	.850	—	—	+0.28	—	—	21.0591
4	4	6.01	24.0	.240	24.0	.240	—	—	-0.41	—	—	5.985
5	1	00.0	00.0	.000	00.0	.000	—	—	+0.22	—	—	

Comments: r = .9999688 b = -0.0021819 0.500 = 12.410466%
m = .0404689

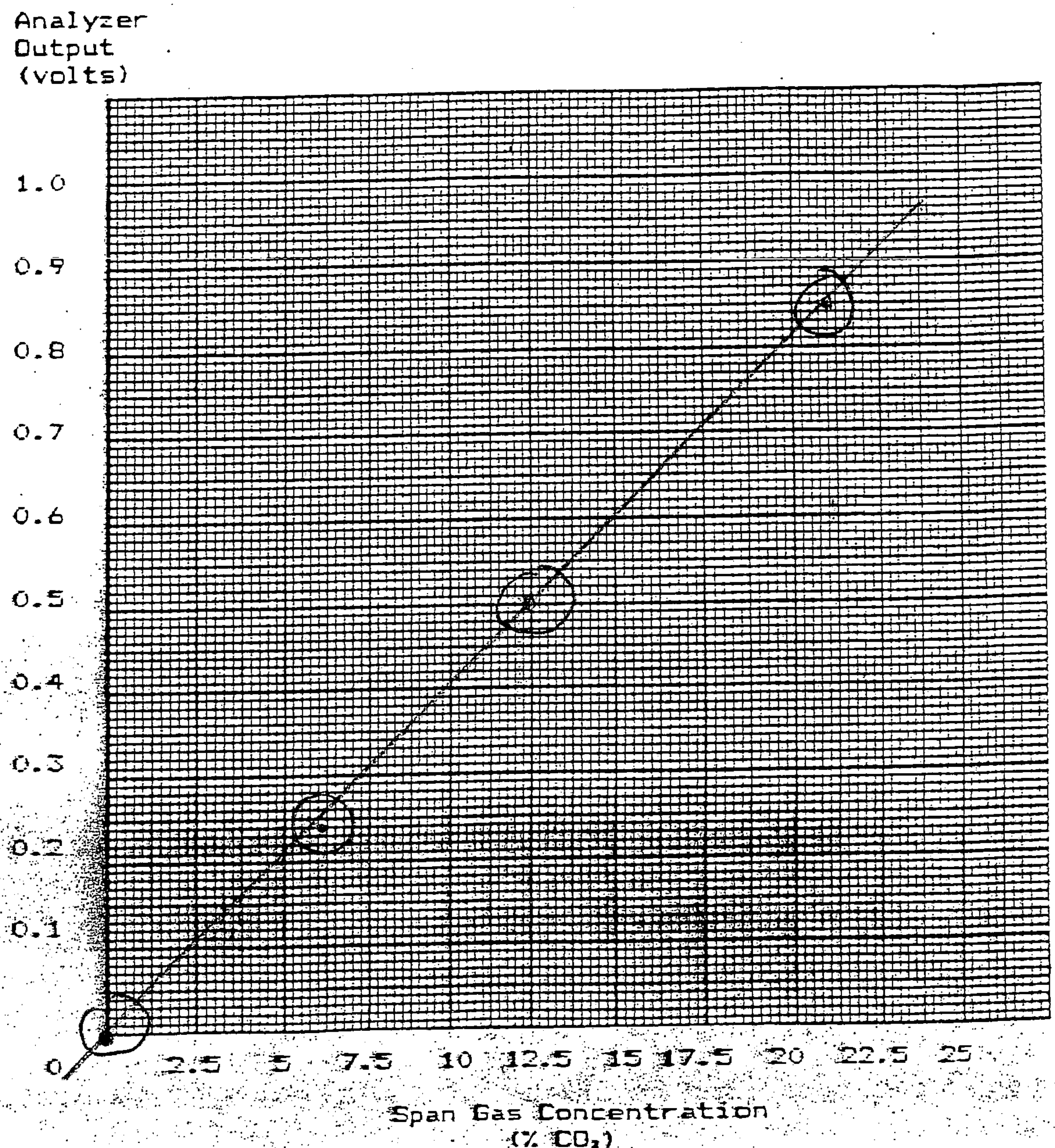
Linear Regression Results:

$Y = MX + B$

Slope (M) = 0.0404639

Y Intercept (B) = -0.0021819

Correlation Coefficient (r) = 0.9999688



Comments

InterMountain Ambient
P.O. Box 5106 ☐ Missoula, MT 59806 ☐ [406] 543-6174

Pre Kuma Ashwood

QA WS 1/85

CO ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Site: Colville, WA Date: 2/16/09

Analyzer: Make: HORIBA Model: MEXA 311 GE SN: GE-30075

Calibration by: A.T. Myren

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter: ✓ Mass Flowmeter: ____
BP: 28.17 "Hg Instrument ID: Princo
Temp: 69°F Instrument ID: Omega Digi

Analyzer last calibrated: 12/19/08 By: A.T. Myren

Cylinders:

1. # TC3AAM154 Concentration: 00.0 % CO Cyl. Press.: 1550 psi.
Certified by: Oxarc Date: 11/12/07

2. # AS90457 Concentration: 2.00 % CO Cyl. Press.: 1480 psi.
Certified by: Matheson Tri-Gas Date: 2/2/2009

3. # 250-1175 Concentration: 4.03 % CO Cyl. Press.: 1490 psi.
Certified by: Oxarc Date: 8/22/97

4. # 250-1088 Concentration: 1.26 % CO Cyl. Press.: 1100 psi.
Certified by: Oxarc Date: 1/31/01

(0-5.0%)
Analyzer: Calibrated Range: 0-10.0 %. Output: 0-1.0 v.

Flow: 1.5 SCFH Measured by: Rotameter: ✓ Mass Flowmeter: ____

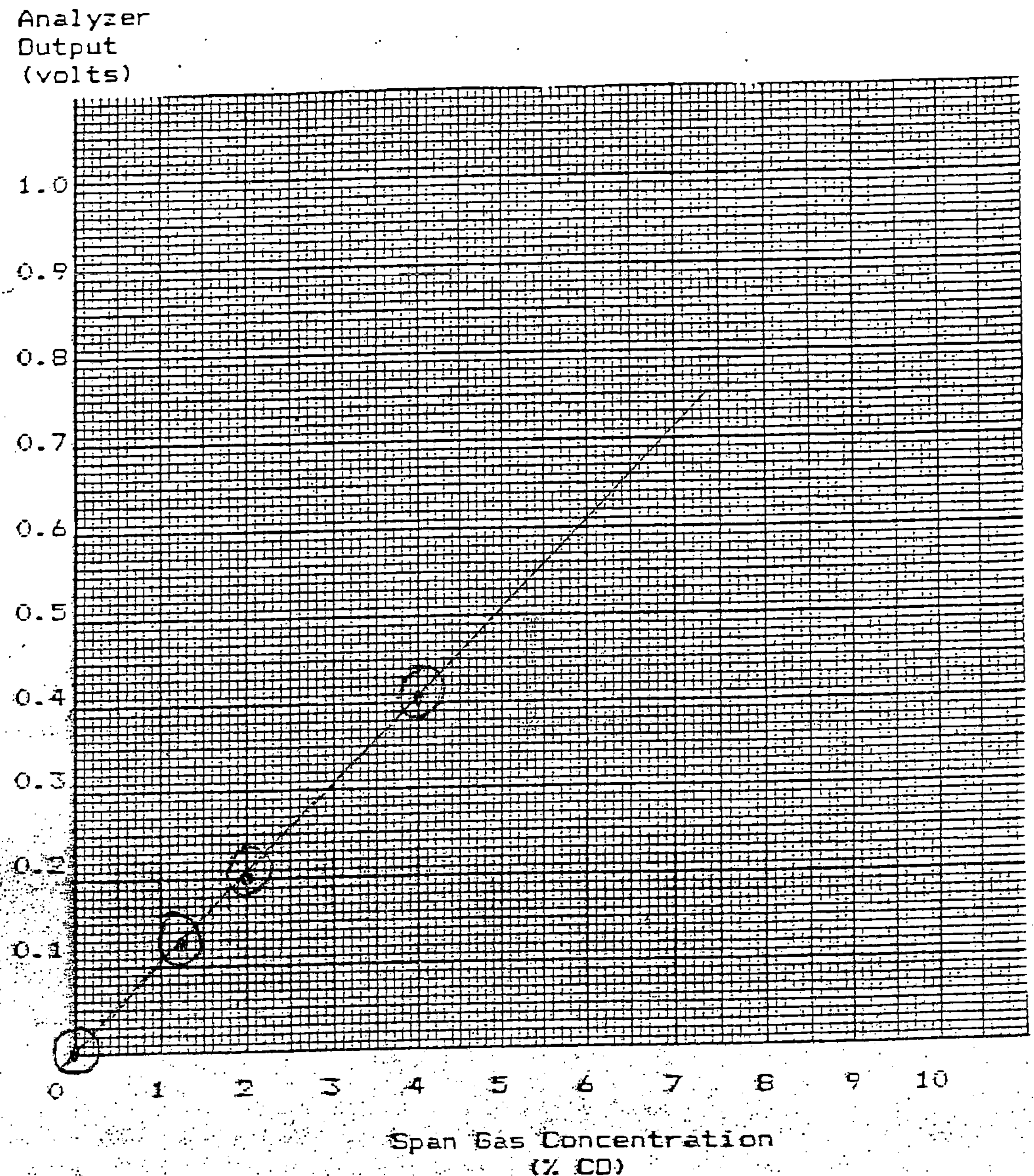
Calibration Results

Point #	Cyl. #	% CO	Expected Meter	Expected DVM	Actual Meter	Actual DVM	Adj. Meter	Adj. DVM	% Dif.	Potentiometer Unadj.	Potentiometer Adj.	
1	1	00.0	0.00	.000	0.00	.000	—	—	-0.04	—	—	.0044
2	2	2.00	2.00	.200	2.00	.200	—	—	+0.30	—	—	2.0059
3	3	4.03	4.03	.403	4.02	.401	—	—	-0.09	—	—	4.0264
4	4	1.26	1.26	.126	1.26	.126	—	—	+0.17	—	—	1.2621
5	1	00.0	00.0	.000	00.0	.000	—	—	-0.04	—	—	

Comments: .200 = 2.0059466 %

Linear Regression Results:

Y = MX + B
Slope (M) = 0.0994832
Y Intercept (B) = 0.0004419
Correlation Coefficient (r) = 0.9999958



Comments

MATHESON TRI•GAS
ask. . .The Gas Professionals™

Matheson Tri-Gas Inc.
6775 Central Avenue
Newark, CA, 94560
Phone: 510-793-2559
Fax: 510-790-6241

Certified Mixture Grade

TO: Oxarc Inc
Attn: Ted Storms
328 West 1st
Colville, WA 99114

PHONE: 509-535-7794
FAX:

TO AVOID BACKFILL, CYLINDER PRESSURE MUST BE GREATER THAN PROCESS PRESSURE

SALES ORDER NUMBER: 476173
P.O. NUMBER: CV12337
LOT NUMBER: 103-96-00348

PRODUCT: 4 COMPONENT MIXTURE

CYLINDER NUMBER: AS 90457
SIZE: 1A
CGA/DISS OUTLET: CGA 590
CONTENT: 168.1 cu. ft.
PRESSURE: 1600 psig

FILL DATE: Feb 2, 2009

COMPONENT	REQUESTED CONCENTRATION	BLEND TOLERANCE (+/-)	CERTIFIED CONCENTRATION	CERTIFICATION ACCURACY
Carbon Monoxide, TECHNICAL	2.00 %	10 %	2.00 %	+/- 2%
Carbon Dioxide, BONE DRY	12.5 %	5 %	12.5 %	+/- 2%
Oxygen, UHP	12.5 %	5 %	12.53 %	+/- 2%
Nitrogen, UHP	BAL		BAL	

TRACEABLE TO REFERENCE STANDARD SOURCE/NUMBER:
TRACEABLE TO NIST TRACEABLE WEIGHT CERTIFICATE: 822/272801-06 822/274081-06

SPECIAL INFORMATION / ADDITIONAL COMMENTS

The product listed above and furnished under the referenced purchase order has been tested and found to contain the component concentration listed above. All values in mole/mole basis gas phase unless otherwise indicated. Matheson Tri-Gas Inc. warrants that the above product(s) conform at the time of shipment to the above description. Matheson Tri-Gas Inc. liability does not exceed the value of the product purchased.

ANALYST	SIGNATURE	DATE SIGNED
Zoran Topalovic	HL	Feb 9, 2009

WELDING PRODUCTS
INDUSTRIAL SUPPLIES
INDUSTRIAL GASES
MEDICAL GASES

oxarc®

SPECIALTY GASES
BEVERAGE SYSTEMS
SAFETY PRODUCTS
FIRE EQUIPMENT

WWW.OXARC.COM

MAIN OFFICE
SPOKANE, WA 99220
4003 E. BROADWAY
P.O. BOX 2605
(509) 535-7794
FAX (509) 535-0368

BOISE, ID 83709
7615 W. LEMHI ST.
(208) 376-0377
FAX (208) 376-1133

[CO]EUR D'ALENE, ID 83814
3530 RAMSEY RD.
(208) 765-3311
FAX (208) 667-5974

COLVILLE, WA 99114
328 W. 1ST.
(509) 684-3776
FAX (509) 684-6742

[E]LLENSBURG, WA 98926
704 N. WENAS
(509) 925-1518
FAX (509) 925-1136

HERMISTON, OR 97838
HERMISTON-McNARY HIWAY
(503) 567-7377
(503) 567-2265

KENNEWICK, WA 99336
800 W. COLUMBIA DR.
(509) 582-4202
FAX (509) 586-9859

LEWISTON, ID 83501
513 3RD. AVE., NORTH
(208) 743-6571
FAX (208) 746-8374

[M]OSES LAKE, WA 98837
1401 WHEELER ROAD
(509) 765-9247
FAX (509) 766-9958

OKANOGAN, WA 98840
2256 ELMWAY
(509) 826-3205
FAX (509) 826-3905

PASCO, WA 99302
716 SOUTH OREGON
(509) 547-2494
FAX (509) 547-3103

TWIN FALLS, ID 83303
29 COMMERCIAL AVE.
(208) 734-9711
FAX (208) 734-7923

WENATCHEE, WA 98801
OHME GARDENS RD.
(509) 662-8417
(509) 662-1229

YAKIMA, WA 98903
1004 EAST MEAD
(509) 248-0827
FAX (509) 452-8704

Primary Standard Certificate of Analysis
Method of Analysis Micro GC / Gravimetric
Customer: Myren Consulting Reference # PM7234-2
P.O.# Cylinder # 250-1175

Results of Investigation

Component	Requested	Concentration
Air	N/A	N/A
Argon	N/A	N/A
Carbon Dioxide	21.0%	21.0%
Carbon Monoxide	4.00%	4.03%
Helium	N/A	N/A
Hydrogen	N/A	N/A
Methane	N/A	N/A
Nitrogen	Balance	Balance
Oxygen	21.0%	21.0%

Hazard Class	UN 1956
DOT Shipping Name	Compressed Gas NOS
Shipping Volume (scf approximate)	160 scf @ ntp
Cylinder Pressure	1500 psig
CGA Valve Connection	350

Oxarc Primary Standard mixtures are prepared with gravimetric techniques using weights traceable to NIST. Mixture blended to +/- 1% relative to minor component and certified to +/- 1% analytical accuracy.

Authorized Signature Travis Auger Date 8/25/97
Travis Auger

Comments:

oxarc.
716 S. Oregon Ave.
Pasco WA, 99301
509-547-2494
SPECIALTY GAS DIVISION

Primary Standard Certificate of Analysis
Cylinder filled in Pasco WA
Method of Analysis Micro GC / Gravimetric
Customer: Myren Consulting Reference # 2010306
P.O.# Cylinder # 250-1088

Results of Investigation

Component	Requested	Concentration
Air	N/A	N/A
Argon	N/A	N/A
Carbon Dioxide	6.00%	6.01%
Carbon Monoxide	1.25%	1.25%
Helium	N/A	N/A
Hydrogen	N/A	N/A
Methane	N/A	N/A
Nitrogen	Balance	Balance
Oxygen	6.00%	6.02%

Hazard Class	UN 1956
DOT Shipping Name	Compressed Gas NOS
Shipping Volume (scf approximate)	182 scf @ NTP
Cylinder Pressure	1691 psig
CGA Valve Connection	350

Oxarc Primary Standard mixtures are prepared with gravimetric techniques using weights traceable to NIST. Mixture blended to +/- 2% relative to minor component and certified to +/- 1% analytical accuracy.

Authorized Signature ________ Date 1/31/01
Travis Auger

Comments:

Bottle 4 Received 7/20/04 1700

Blank done 12/13/07

Certificate of Analysis

ANALYTICAL CONTROL LABORATORY ANALYSIS
ACETONE - OPTIMA

Catalog No. A929 April 29, 2004

Lot No. 041648

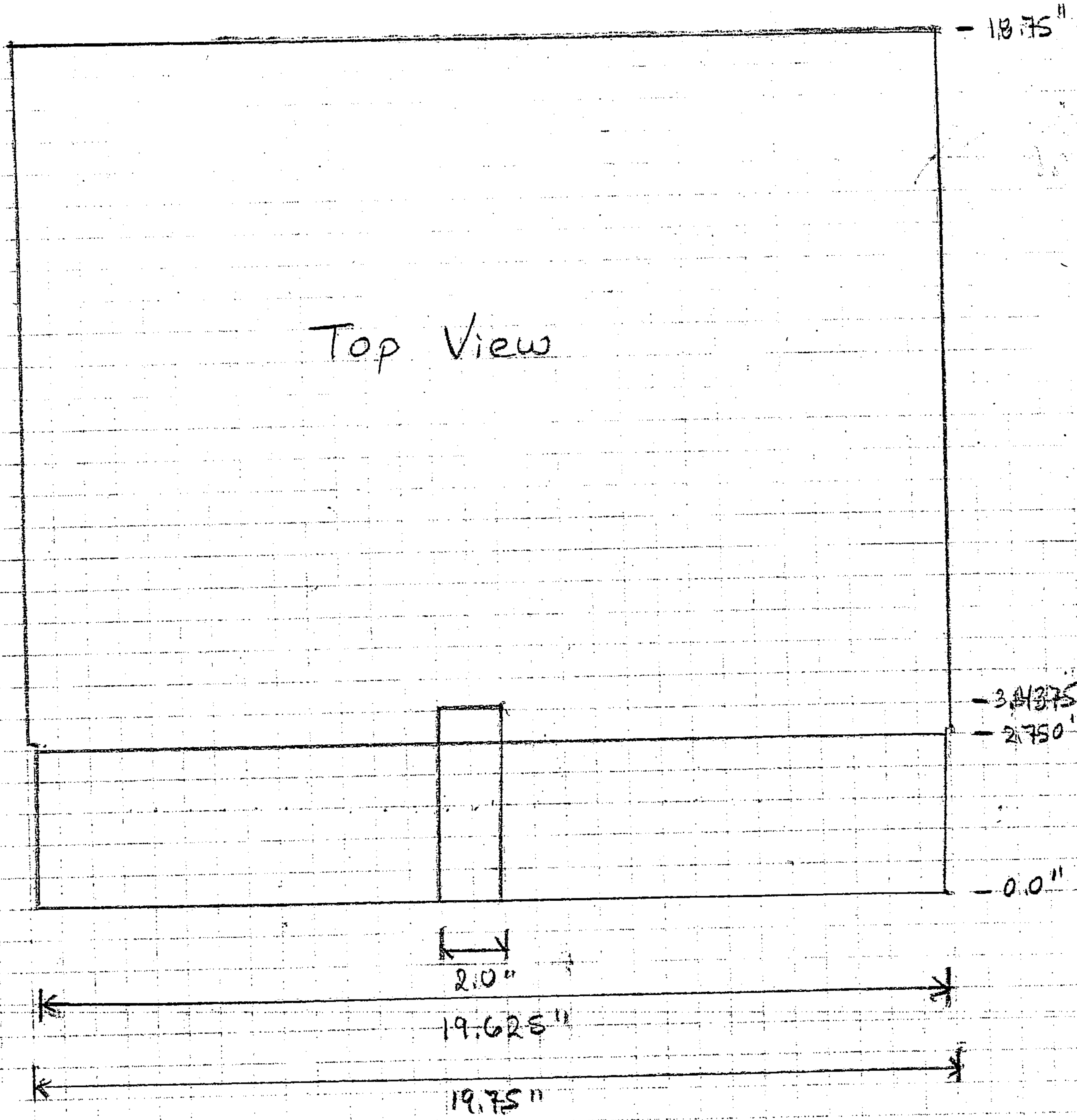
This is to certify that this lot was tested and found to comply with the specifications for this product. The following are the actual analytical results obtained:

TESTS		ACTUAL ANALYSIS
Assay		99.5%
Color		5 APHA
Description		Clear, Colorless Liquid
Identification		Pass Test
Fluorescence Background (as Quinine Sulfate)		Not More Than 1 ppb
Pesticide Residue Analysis (As Heptachlor Epoxide)		Not More Than 10 ng/L
Substances Reducing Permanganate		Pass Test
Solubility in Water		Pass Test
Aldehyde (as HCHO)		0.0005%
Density (g/ml) @ 25 Degrees C		0.7854
Methanol (CH3OH)		0.03%
Isopropyl Alcohol ((CH3)2CHOH)		0.01%
Optical Absorbance	At 400 - 350 nm	0.002
	At 350 nm	0.003
	At 340 nm	0.05
	At 330 nm	0.65
Refractive Index at 25°C		1.3556
Residue after Evaporation		0.6 ppm
Titratable Acid		0.0002 Meq/g
Titratable Base		<0.0001 Meq/g
Water (H_2O)		0.5%

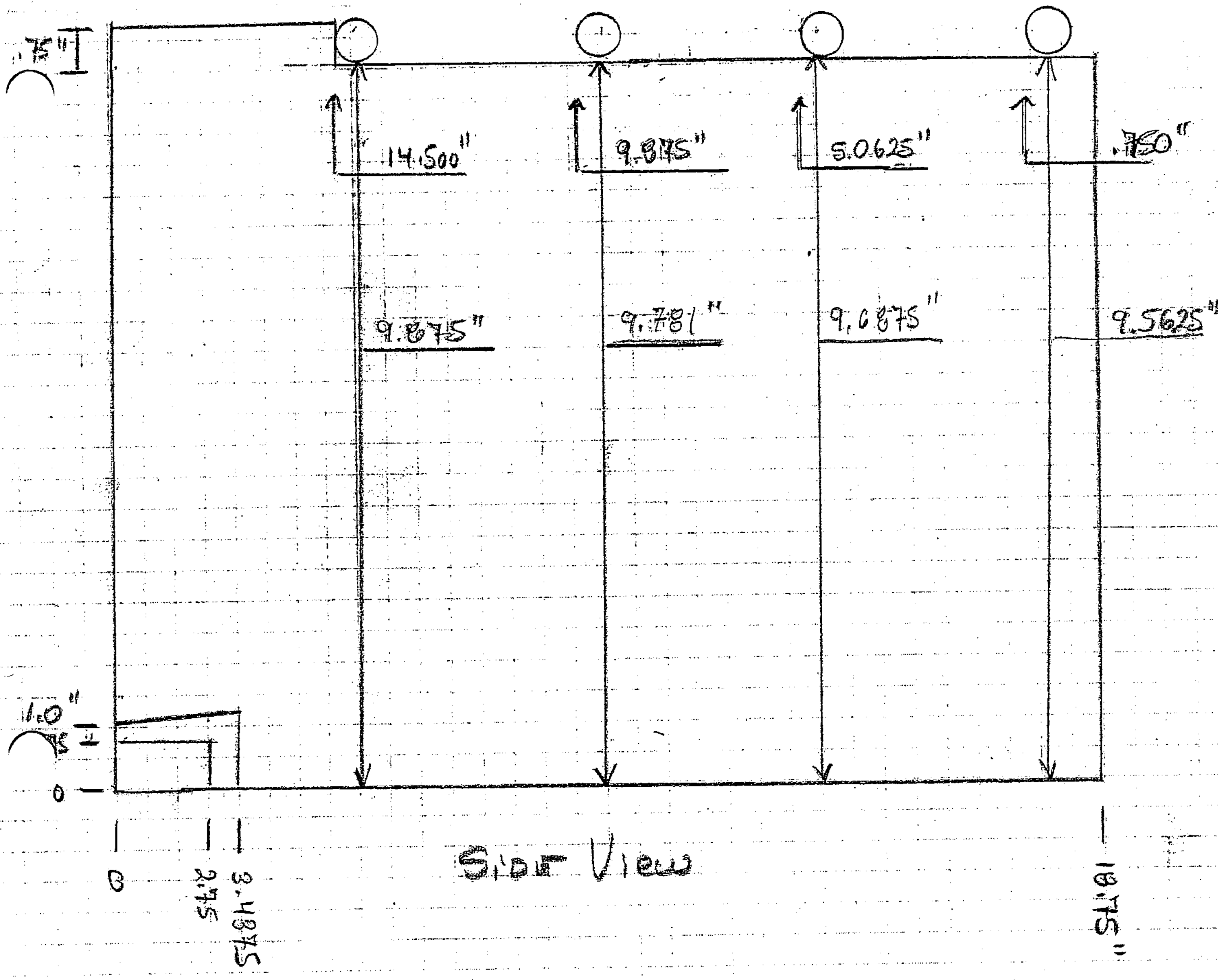
Approved By: Edgar E. Hess

Edgar E. Hess
Q.C. Laboratory Manager

Fisher Scientific
Chemical Division
1 Reagent Lane
Fair Lawn, N.J. 07410
201-796-7100



Kuma Ashwood
Not to Scale
3/5/09
A.T. Myren
Page 1 of 4



Kuma Ashwood
Not to Scale
3/5/09
A.T. Myren
Page 2 of 4

Kuma Ashwood - Useable Firebox Volume Calculations

A: 19.750" X .750" X 9.5625" = 141.645 in^3

B: 19.750" X $\frac{9.5625+9.875}{2}$ X (18.75-(4.25+.75)) = 2639.248

C: 19.75" X 9.875 X (4.25-2.75) = 292.547

D: 19.625" X 9.875 X 2.75 = 532.941

E: 19.625" X 4.25 X .75 = 62.555

3668.936 in^3

Less:

Btm Duct

2.75 X 0.75 X 19.625" = 40.477 in^3

LPAO

.75 X .75 X 2 = 1.125

$\frac{1+1.5}{2}$ X 2 X 3.4375 = 8.594

50.196 in^3

3668.936 in^3 - 50.196 in^3 = 3618.740 in^3

3618.740 in^3 ÷ 1728 in^3/ft^3 = **2.094 ft^3** Useable Firebox Vol.

Fuel Load Weight Calculations:

2.094 ft^3 x 7 lbs/ft^3 = 14.659 lbs - Ideal Fuel Load Weight.

14.659 ± (0.10 x 14.659) = 16.125 = 16.1 lbs. 〉 Fuel Load Weight

= 13.193 = 13.2 lbs. 〉 Range.

Fuel Piece Length (Maximum)

19.750" x 0.8333 = 16.458" = 16.4375" (16 7/16")

A.J. Myren

STOVE QC

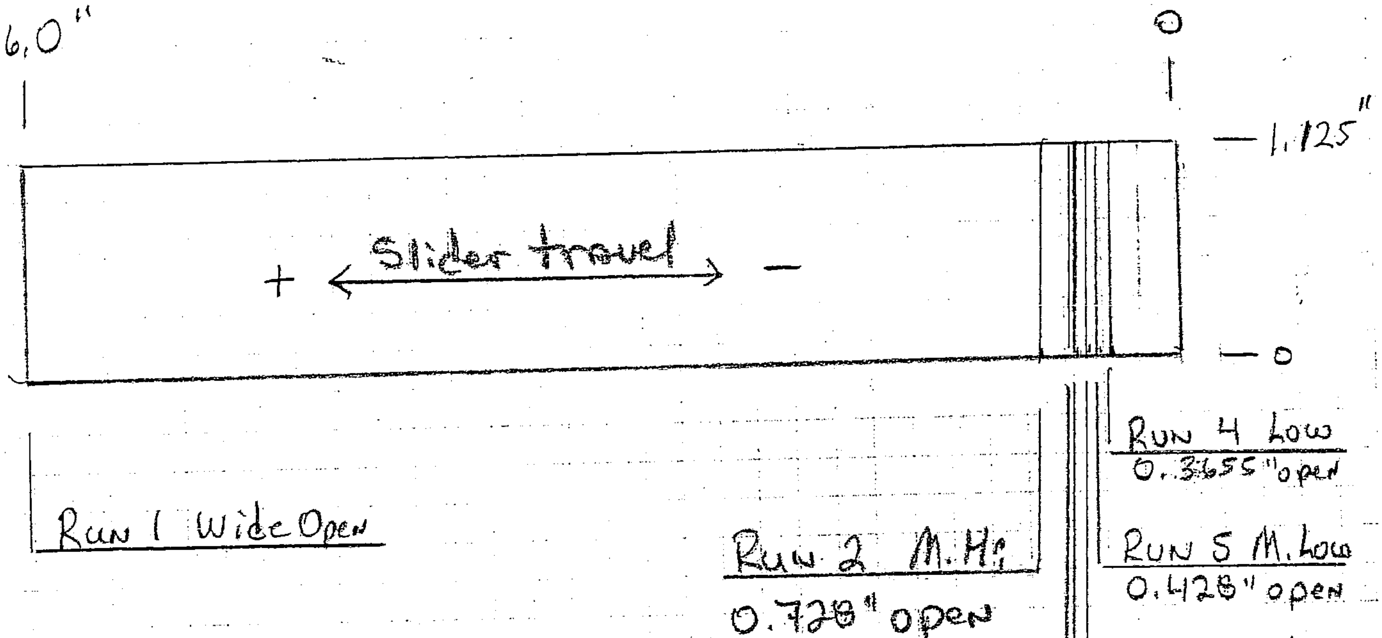
The Kuma Ashwood noncatalytic wood stove is a medium sized stove with a useable firebox volume of 2.1 cubic feet. It has several distinguishing features. They are as follows:

1. The unit is specifically designed with a 2.75″ combustion air inlet that can be hooked up to a duct delivering outside air to the unit. There are 2 inlet locations, one on the bottom of the unit that will be used when the unit is installed as a freestanding unit on legs or a pedestal and one on the back of the unit that will be used when the unit is installed as a fireplace insert. The cover plate for the inlet hole not being used is moved from one location to the other and attaches with 2 screws.
2. The unit was tested with an ash pan.
3. The unit is designed so that it can be installed as either a freestanding unit or as a fireplace insert.

The critical dimensions in this stove are as follows:

1. Vertical Throat Dimension: 2.375″
2. Horizontal Throat Dimension: 1.25″
   Note: The vertical and horizontal throat dimensions are measured at the front edge of the baffle.
3. Air Wash Gap: 0.3125″
4. Minimum Primary Air Setting: 0.3655″. See drawing on page 4 of 4 in this Section.
5. Lower Primary Air Orifice - Inlet Orifice: 1-0.4375″ hole
6. Lower Primary Air Orifice - Outlet Orifices: 1-0.25″ and 2-0.1875″ holes
7. Secondary Air Tubes
   Front: 40-5/32″ holes on 1/2″ centers
   Middle Front: 52-3/32″ holes on 3/8″ centers
   Middle Rear: 52-3/32″ holes on 3/8″ centers
   Rear: 20-3/32″ holes on 1″ centers
8. Combustion Air Inlet Orifice (Outside Air Hookup): 2.75″ diameter hole.
9. Secondary Air Inlet Orifice: 1.75″ X 0.75″
10. (Adjustable) Primary Air Inlet Orifice: 1.125″ X 6″, of which 0.3655″ is always open.

Kuma Ashwood
Primary Air Inlet Orifice Settings



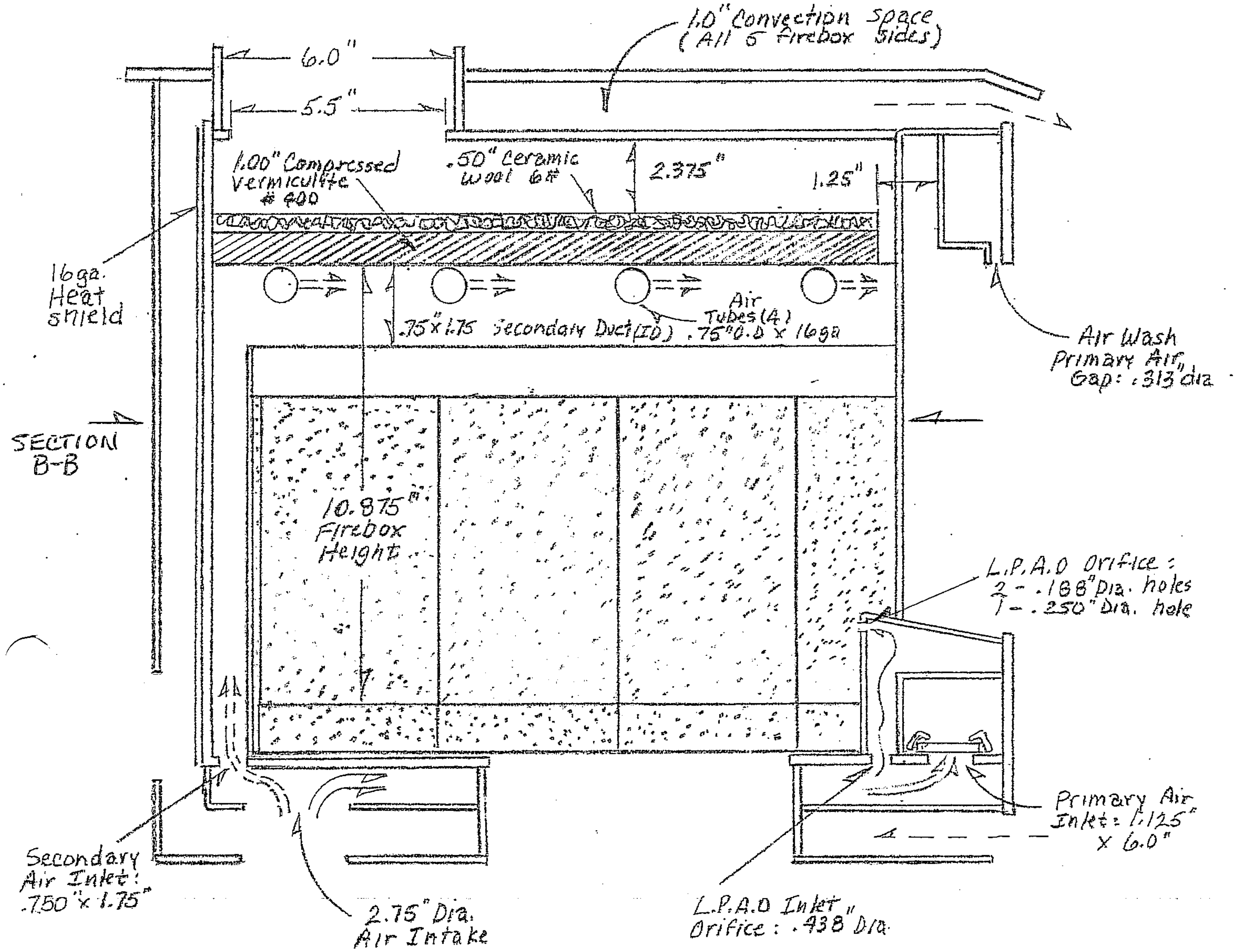
The primary air adjustable inlet orifice is 6.0" x 1.125". To increase the amount of air pull the slide to the left, to decrease the amount of push the Sider to the right. Note: The Slider rod exits the unit on the L side of the stove.

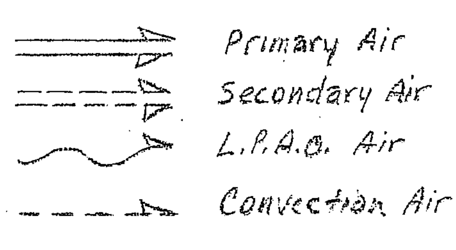
Kuma Ashwood
N to Scale
4/9/09 A.T. Myren
P. 4 of 4

Ashwood Part Specifications

Part #	Description	Dimensions (inches)	Quantity	Composition
1	Firebox assembly	18.75x20x16.25	1	3/16" Low carbon steel
2	Firebox top	18.5x22.5	1	¼" Low carbon steel
3	Flue collar	2.0 height 6.0 diameter	1	3/16" Low carbon steel
4	Primary draft channel (cross sectional area)	Sides-1.25x2.5 Bottom- 2.0x2.5 Top – 1.5x3.0	2 1 1	10ga. Low carbon steel 10ga. Low carbon steel 10ga. Low carbon steel
5	Primary draft control	1.5x6.5	1	¼" Low carbon steel
6	Secondary draft ducts	Sides 2.0x16.25 Rear- 2.0x20.50 Riser- 2.0x10.50	2 1 1	10ga. Low carbon steel 10ga. Low carbon steel 10ga. Low carbon steel
7	Convection shell	22.0x25.0x19.5	1	12ga. Low carbon steel
8	Heat Shield	16.0x22.5	1	16ga. Low carbon steel
9	L.P.A.O. Tower	2.0x3.5x3.5	1	12ga. Low carbon steel
10	Primary fee duct	1.0x12.0x20.0	1	12ga. Low carbon steel
11	Secondary burn tubes	21.0x.75 diameter	4	16ga. Low carbon steel
12	Gaskets	Door seal- 57.6x.625 diameter Glass seal- 50.4x.750	1 1	Woven fiberglass 96.5% Fibrous glass 3.5% surface sizing
13	Firebrick	4.5x9.0 2.5x9.0 4.5x7.5 2.5x7.5 4.5x5.75 1.25x4.5	10 2 6 2 1 1	81% Fireclay 19% Silica alumina
14	Baffle	1.0x16.75x20.5	1	#400 compressed vermiculite
15	Baffle wool blanket	.50x16.75x22.50	1	Ceramic wool fiber 6#/sq.ft. density
16	Blower motor	20.0x3.0 diameter	1	EBM Pabst C-Frame motor dual tangential variable speed controlled
17	Door	14.0x19.0	1	Cast Iron
18	Glass	10.75x15.50	1	5mm Neo-Ceramic
19	Ash Drop Plenum	4.0x8.0x2.25	1	.25" rectangular steel tubing

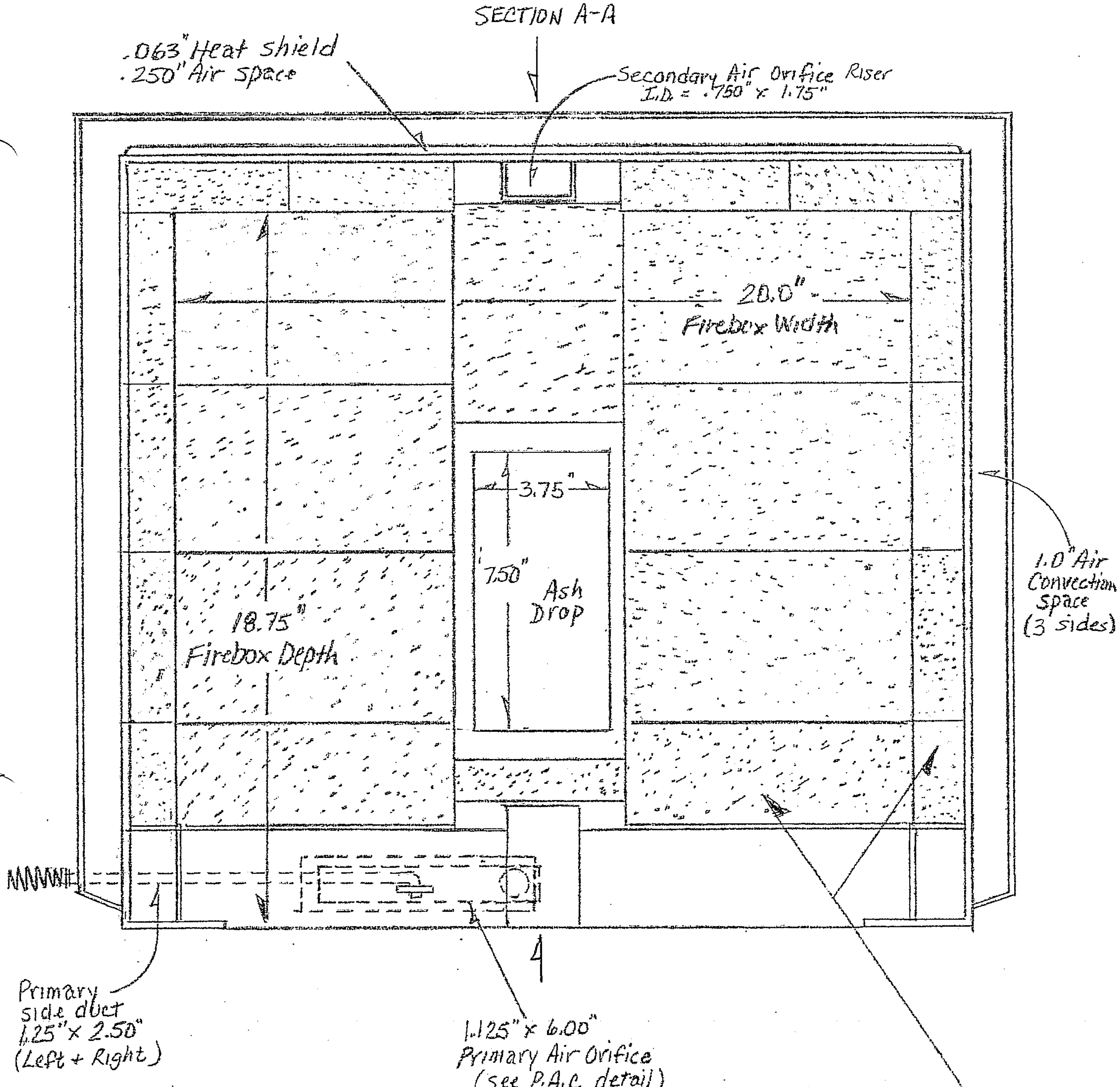
Note: - all dimensions given are O.D. For actual area regarding air flow etc. see drawings.
- Components listed above are actual stove body parts that involve combustion and operation of the unit. List does not include pedestal, legs etc.





NOTE: ALL DRAWINGS ARE STOVE BODY ONLY AND DO NOT INCLUDE LEGS OR PEDESTAL.

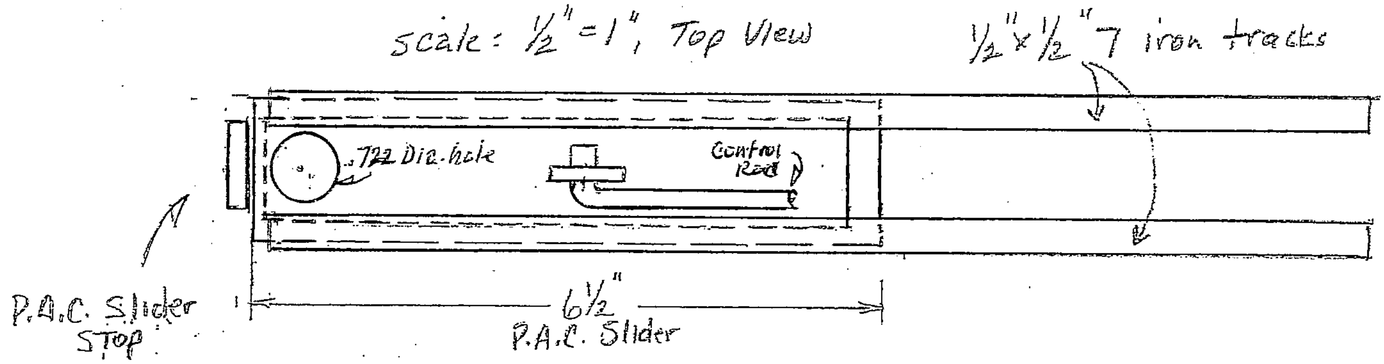
TITLE: KUMA MODEL: ASHWOOD	DR # 1	DR BY M.F.
VIEW CROSS-SECTION A-A	DATE 3/09	SCALE 1/4" = 1"

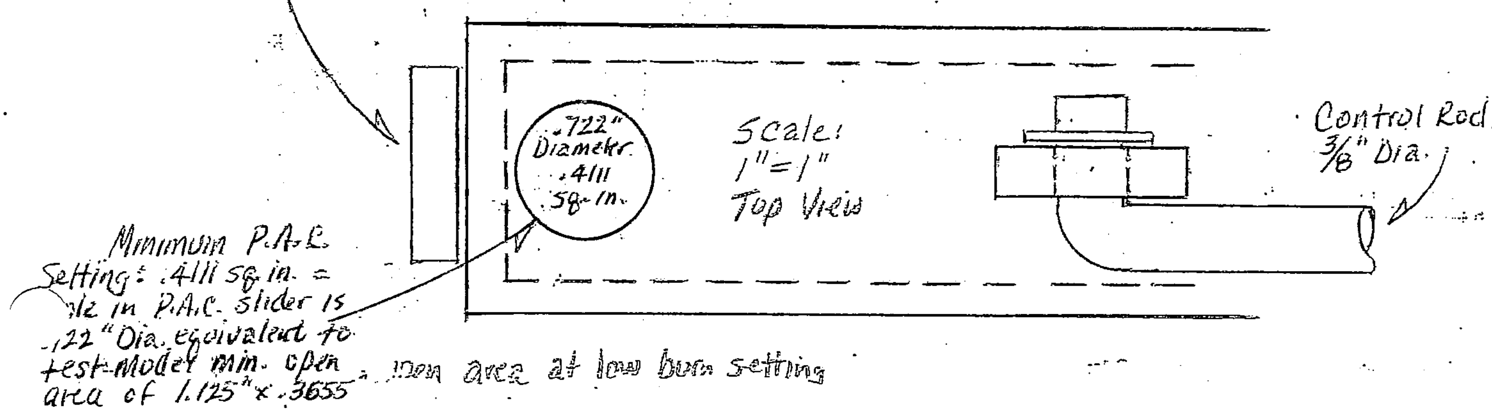


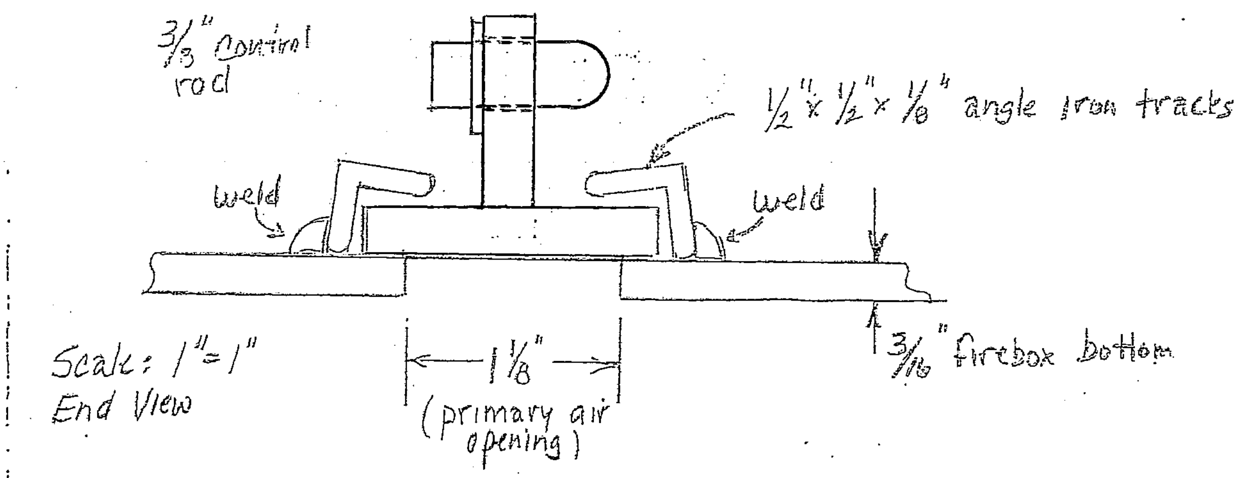
ALL FIREBRICK
SHOWN TO SCALE :
9.5 - BOTTOM BRICKS
4 - LEFT SIDE
4 - RIGHT SIDE
4 - REAR WALL
COMPOSITION: LOW-DUTY
FIREBRICK MFG. BY MUTUAL
MATERIALS INC.
81.0 % FIRECLAY
19.0 % ALUMINA SILICA

TITLE: KUMA MODEL: ASHWOOD	DR # 2	DR. BY M.F.
VIEW: CROSS-SECTION , B-B	DATE 3/09	SCALE 1/4" = 1"

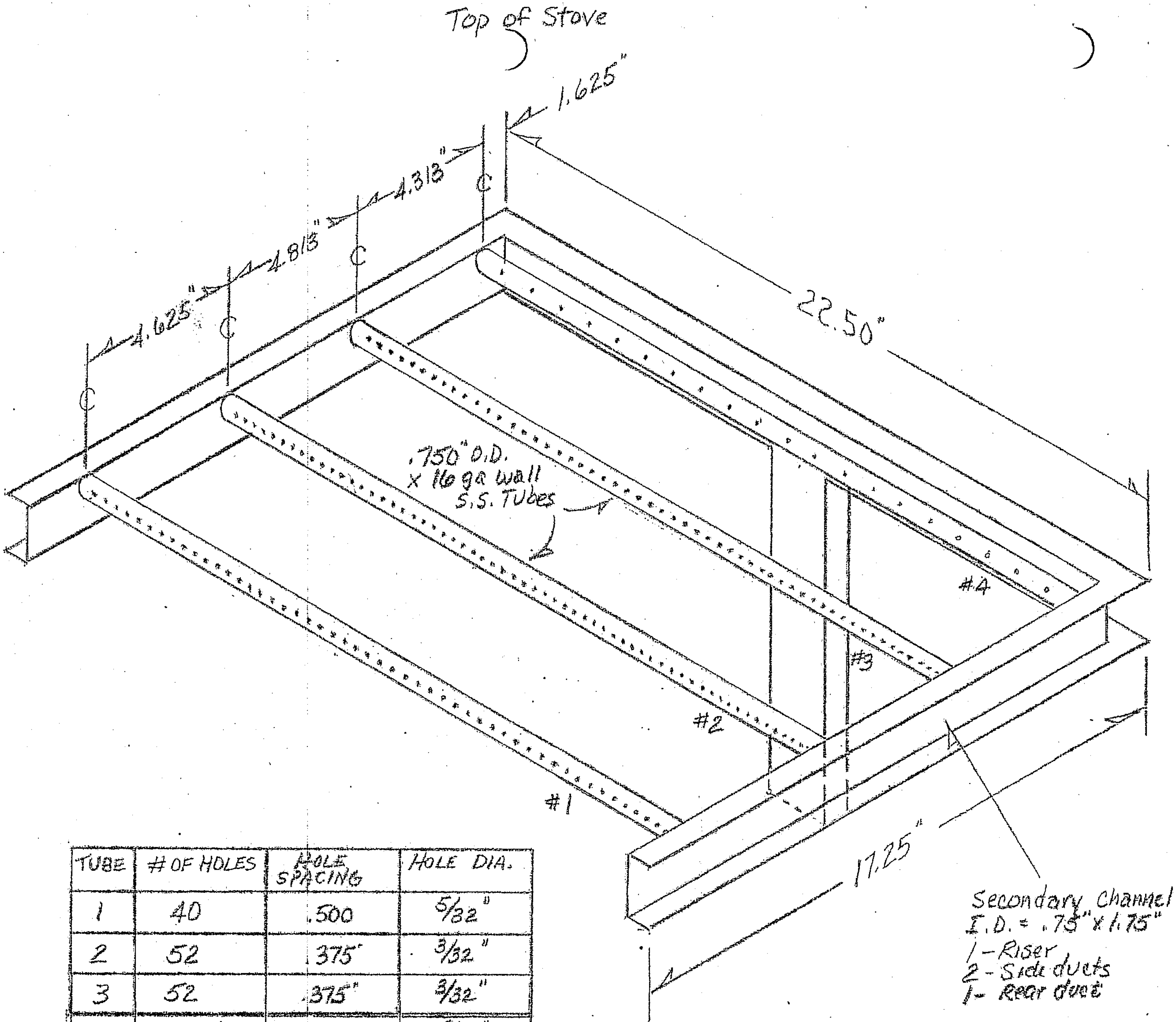
- - - - - = 1 1/8" x 6" primary air opening
——— = 1/4" x 1 1/2" P.A.C. Slider





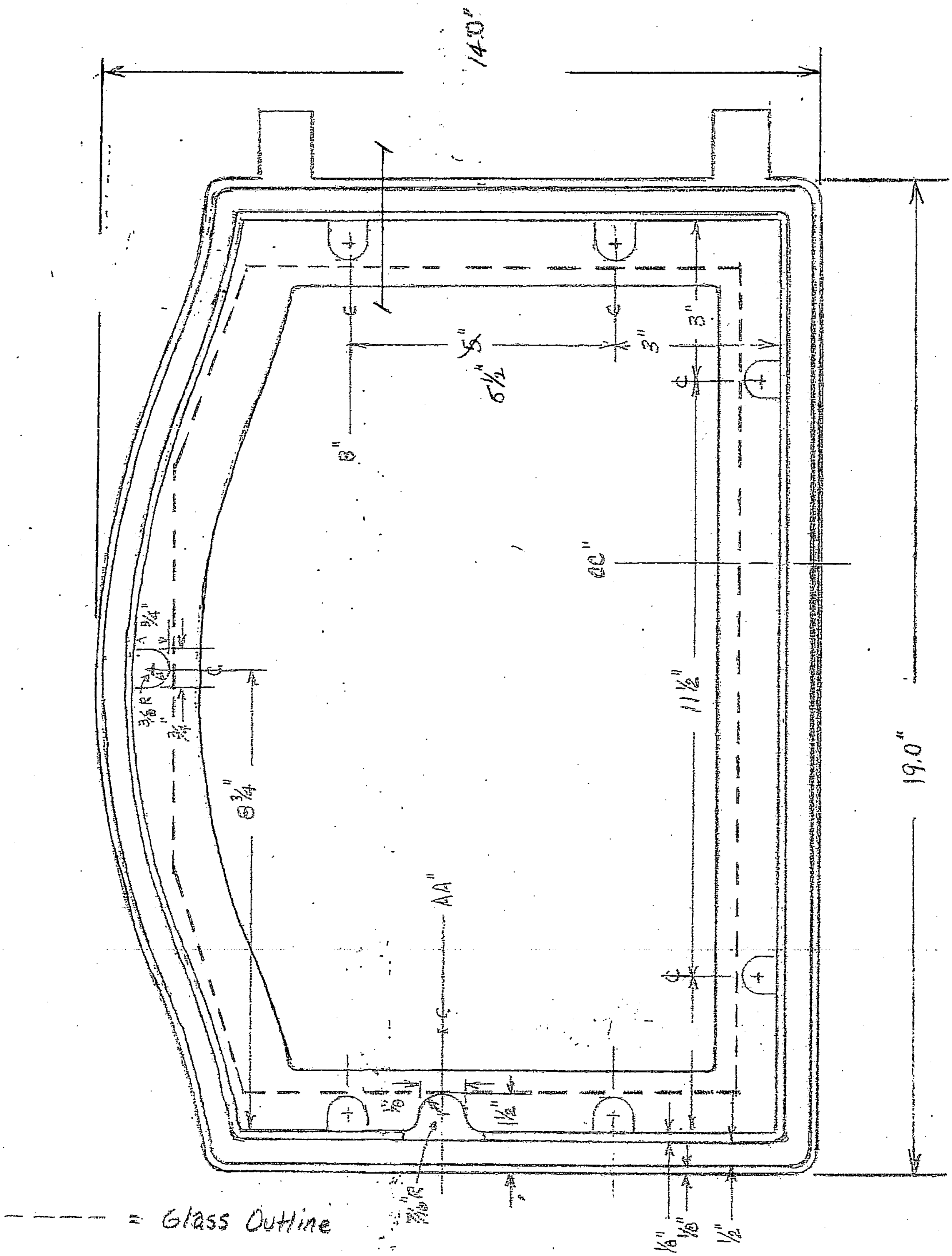


TITLE:	DR. NO.	DR. BY:
KUMA MODEL: ASHWOOD	3	M.F.
VIEW: PRIMARY AIR CONTROL DETAIL	DATE: 3/09	SCALE: AS NOTED

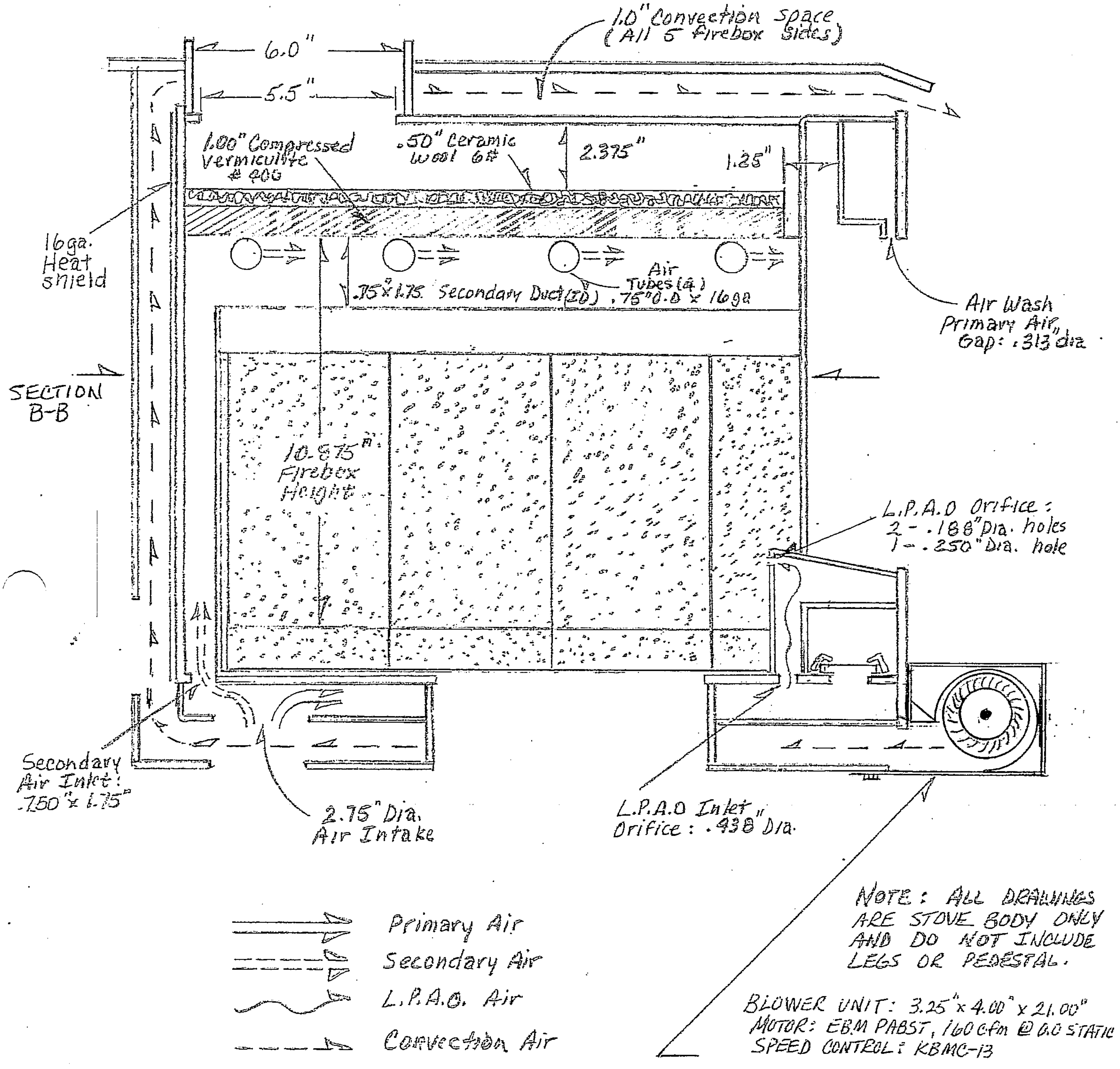


TUBE	# OF HOLES	HOLE SPACING	HOLE DIA.
1	40	.500	5/32"
2	52	.375"	3/32"
3	52	.375"	3/32"
4	20	1.0"	3/32"

TITLE:	DR #:	DR. BY
KUMA MODEL: ASHWOOD	4	M.F.
VIEW: SECONDARY PERSPECTIVE	DATE: 3/09	SCALE: 1/4" = 1"



TITLE: KUMA MODEL: ASHWOOD	DR # 5	DR BY: M.F.
VIEW: DOOR, BACK	DATE: 3/09	SCALE: 3/8"=1"



TITLE:	DR #	DR BY
KUMA MODEL: ASHWOOD	6	M.F.
VIEW	DATE	SCALE
BLOWER AIR FLOW	3/09	1/4" = 1"

KUMA STOVES, INC.

Operating instructions

Primary Air Control: Set primary air control so that the end of the rod attached to the slider is set at:

	Th. Rod	Amt. Orifice is open.
Low	2.309"	0.3655"
M. Low	2.309"-2.5935"	0.3655"-0.650"
M. High	2.5835"-2.8935"	0.550"-0.950"
High	Wide Open	6.00"
FCT	2.309"-2.5935"	0.3655"-0.650"

Door: Close the door as soon as the fuel is loaded. If the fuel load is slow to ignite, crack the door open 1/8". Adjust the door opening to maximize impact of air flow from door opening in the coal bed. Close the door as soon as the fuel load ignites.

Fan: Operate fan as follows. Note that the low setting is when the knob on the speed control is turned clockwise as far as possible.

Low	On low at 30 minutes.
M. Low	On low at 30 minutes.
M. High	On low at 30 minutes.
High	On High at 5 minutes.

LPAO: Clear coals away from in front of the LPAO for all runs.

2150 W HAYDEN AVE HAYDEN ID 83835
PHONE (208) 762-8002 FAX (208) 762-5862

KUMA STOVES

Hayden ID, USA

MODEL# Ashwood

Testing being performed by Omni Test Laboratories

This manual covers the following Kuma stove model:

K-ASH

INSTALLATION AND OPERATING INSTRUCTIONS

<u>SAVE THESE INSTRUCTIONS</u>

Revised 4-2-09

Welcome to the Kuma family.

Kuma is a modified version of the Greek word Kauma which means "a great heat".

We would like to take the time to say thank you for purchasing a Kuma stove. If this is your first Kuma stove, you have joined a long list of family members, some since 1981. We are a family business that still desires to maintain a good relationship with each and every one of our customers. Our mission is to provide you with a quality product that will last a lifetime. If you ever have a problem with your stove, we will do what is needed to get it resolved and keep you warm.

You may have noticed a portion of the Bible enclosed in your owner's packet. It is a small gift for you. Our faith in Jesus Christ is very important to us and we have that faith because there is hope in heaven. That hope comes from the message of truth that is found in this new testament.

Thank you for allowing us the opportunity to warm your house. May God bless you and we anticipate that you will enjoy the use of your new Kuma wood stove.

Sincerely,

The Freeman Family

Under specific test conditions, this heater has been shown to meet the U.S. Environmental Protection Agency and Washington State emission limits for residential wood stoves.

Please read the safety precautions and the entire installation and operation instructions carefully. Failure to properly install and maintain your wood stove can result in an unsafe condition.

Contents

Section 1 – Safety Precautions

Install and use in accordance with the manufacturers installation and operation instructions contained in this manual only.

1. If this stove is not properly installed, a house fire can occur. For your protection, follow the installation instructions provided. We recommend contacting local building or fire officials regarding restrictions and installation inspection requirements in your area. **We also recommend that your Kuma stove be installed by a properly trained and licensed installer, preferably an NFI (National Fireplace Institute) expert.**
2. DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVICING ANOTHER APPLIANCE.
3. Do not use gasoline, gasoline-type lantern fuel, kerosene, charcoal lighter fluid, or similar liquids to start or "freshen up" a fire in this heater. Keep all such liquids well away from the heater while it is in use.
4. Do not burn garbage.
5. DO NOT OVERFIRE. If any part of the stove or chimney glows, the stove is in an overfire condition. If this happens, shut the air control off immediately.
6. WARNING: DO NOT INSTALL IN A SLEEPING ROOM
7. CAUTION: The structural integrity of the floor, wall and ceiling/roof must be maintained.
8. DO NOT USE SINGLE WALL PIPE FOR ANY CHIMNEY APPLICATION, EXTERIOR OR THROUGH THE WALL OR CEILING. Single wall pipe may only be used as a connection between the stove and an approved masonry or stainless steel chimney. **Single wall pipe may not be used as a connector in mobile homes.**
9. When installing into an existing masonry or metal chimney, examine the chimney system carefully. If you have any questions, seek professional advice. We recommend having existing chimneys cleaned and inspected by a qualified professional prior to the installation of your new stove.
10. NOTE ALL MINIMUM CLEARANCE REQUIREMENTS TO COMBUSTIBLES. Installation must comply with minimum clearances as listed in this manual. (see section 6)
11. Do not operate this stove with the door in an open position.
12. Do not operate this stove with the ash pan open.
13. This stove must be connected to a minimum 6" diameter listed chimney that complies with U.L. type 103HT factory built chimney or a code approved masonry chimney. If the masonry chimney does not meet code, a U.L. 1777 approved liner must be installed.
14. When connecting single wall or double wall connector pipe to the stove and chimney, use 3 screws per pipe joint including 3 screws securing the pipe to the stove. Depending on the type of double wall pipe you are using, it may also be necessary to fasten it at the chimney. Simpson Duravent's DVL double wall uses a snap lock connector and does not need screws.
15. When connecting this stove to a masonry chimney, make sure you observe all applicable clearances including walls, ceilings and other combustible material. A masonry chimney must be minimum 6" diameter and constructed with a liner according to NFPA code 211. If you have any questions about the condition or the code compliance of your masonry chimney, please speak with a qualified professional. WHEN PENETRATING A COMBUSTIBLE WALL TO CONNECT TO AN OUTSIDE MASONRY CHIMNEY YOU MUST BE CERTAIN THAT THE WALL PASS THROUGH IS A SAFE AND LISTED METHOD. Please refer to NFPA code 211 for details about listed wall pass through methods. To obtain a copy of the NFPA code 211, you may visit their website at www.nfpa.org or call them toll free at 1(800)344-3555. Your local building deptartment may also have information regarding NFPA code 211.

Section 2 – Mobile home installation (Leg or Pedestal)

INSTALL AND USE IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION AND OPERATING INSTRUCTIONS ONLY. WHILE MOST ANYONE WITH BASIC CARPENTRY SKILLS CAN SUCCESSFULLY AND SAFELY INSTALL THEIR KUMA WOOD STOVE, IT IS HIGHLY RECOMMENDED THAT IT IS INSTALLED BY A QUALIFIED PROFESSIONAL WHO IS PROPERLY TRAINED AND LICENSED–PREFERABLY AN NFI CERTIFIED (NATIONAL FIREPLACE INSTITUE) EXPERT.

CAUTION: The structural integrity of the mobile home floor, walls and ceiling/roof must be maintained. Use additional bracing if required. Never cut a load bearing wall or engineered truss. Use elbows if necessary to offset the pipe.

CAUTION: NEVER INSTALL A STOVE IN A SLEEPING ROOM.

STEP 1:Make sure you have the proper tools, materials, and stove components.

Tools:

1. Reciprocating Saw
2. Assorted Screwdrivers
3. Measuring Tape
4. Pencil
5. Plumb Line
6. Electric or Cordless Drill with assorted drill and driver bits
7. Tin Shears
8. Utility Knife
9. Pliers
10. Hammer
11. Assorted Wrenches

Materials:

1. Caulking to seal roof flashing and storm collar. High temperature silicone is recommended.
2. Assorted heavy duty nails and screws.
3. Short pieces of 2x4 or 2x6. Two pieces minimum 24" long.
4. Copper wire (8 gauge) for grounding. Grounding "clamp" "terminal" or "lug" for attaching ground wire at stove and mobile home frame.

Stove Components: (each component has installation instrucions included see sec. 8 for a complete list of accessories)

1. Stove body (K-ASH)
2. Pedestal or leg kit (KA-ASHPED, KA-WLEGSTEEL, etc.)
3. Door Kit (DOOR2CASTC, DOOR2GOLDC, etc.)
4. Outside air kit (KA-OUTSIDEAIR)
5. Optional Blower (KA-BLOWER2)

Determining the stove location:

When choosing a stove location there are a few things that should be considered.

1. Try to choose a location that is centrally located in the house.
2. Try to choose a location that will be easy to access from your wood storage area.

3. Survey the roof area above and around the location of the chimney exit. Be sure there are no dormers, roof valleys or any other roof irregularities that could cause difficulty when trying to set and seal the roof flashing.
4. If possible, survey the attic area above and around the location of the chimney. Be sure there are no major obstructions such as plumbing, heating ducts, electrical wires, phone cables, etc. Also check the crawl space below and around the stove location for the same obstructions.

STEP 2: Installing the chimney.

Use only 6" Class A solid fuel chimney that has been U.L. Safety tested for wood stoves.

IMPORTANT: These instructions are a very basic guideline for the steps to installing your chimney. For complete instructions, refer to the installation manual that came with your chimney. Chimney installation instructions are usually located in the box with the chimney cap or chimney support components. If you have any questions about the installation of your chimney, please contact the dealer where you purchased your stove.

CAUTION: Inspect all chimney components for damage. Do not use any damaged chimney components.

1. Familiarize yourself with the clearances of the stove, for the configuration in which you have chosen to install, i.e. corner installation or straight wall installation (see section 6). Notice the clearances listed for the chimney, this will help you determine the location of the hole in the ceiling.
2. Once you've determined the hole location for the chimney, use a drywall saw or reciprocating saw to cut the ceiling to the desired hole size. BE SURE TO CHECK FOR OBSTRUCTIONS BEFORE CUTTING THE HOLE, REFER TO PIPE INSTALLATION INSTRUCTIONS FOR HOLE SIZE.
3. Use a plumb to transfer the ceiling hole center to the underside of the roof sheeting in the attic. Once you've marked the hole center on the roof sheeting, drill a hole from the inside or poke a screw or nail through the sheeting so you can find that location once you're on the roof.
4. **Always be careful when using a ladder and working on a roof. Have someone hold the ladder for you while you are climbing up and down. Use a positioning belt or harness and safety rope to secure yourself on the roof.** Locate the hole or screw/nail on the roof that you poked through from the attic. Lay the roof flashing down and center over the hole, screw or nail. Using a pencil, trace the inside of the flashing cone onto the roof. Remove the flashing and use a reciprocating saw to cut out the hole. **Cut the hole out about 1" larger than the mark all the way around.**
5. Use the two pieces of 2x4 or 2x6 to brace across the trusses in the attic. Position the bracing in a way that you will be able to attach the chimney support with the proper clearance to the bracing (see chimney installation instructions for proper clearances). Attach the chimney support to the bracing using screws or nails.
6. Using a flat pry bar, gently lift the shingles off the roof from the middle of the hole up. Slide the flashing up under the shingles on the top half of the hole and let the flashing sit on top of the shingles on the bottom half of the hole. Use silicone or roof tar to seal underneath the flashing and use screws or nails to fasten the flashing to the roof. Be sure to apply a small amount of sealer to each screw head.
7. Slide the first section of chimney through the flashing and into the chimney support. Chimney supports vary from one brand of pipe to another. Be sure that the first section of pipe is well secured into the chimney support, again, paying close attention to the chimney manufacturers installation instructions.
8. Continue to fasten chimney sections above the first one until the correct height is reached (see pipe installation instructions).
9. Install the chimney cap.
10. Install the storm collar above the flashing and use high temp silicone to seal.

11. If necessary, install a roof brace or guy wires to steady the chimney. Bracing is usually required if the chimney extends more that five feet above the roof.

STEP 3: Installing the hearth and outside air vent

1. The hearth must be a minimum 3/8" thick non-combustible material and must extend beyond the base of the stove 6" to the sides and back and 16" to the front (see section 6)
2. **When building a hearth pad on site, be sure to leave an area open for the installation of the outside air vent.** Once the hearth is positioned according to the minimum clearances, locate and mark out the hole for the 4" outside are vent. On a pedestal model stove, this hole may be anywhere under the stove base. On a leg model stove, try and locate the hole to line up with the hole in the bottom of the stove. On a pre-manufactured hearth, use a hole saw or circular saw to cut through just the backing board then use a hammer and firmly hit the tile or stone on the top side. If the backing board was cut to the correct depth, the tile or stone will break out very clean. Also using a hole saw or circular saw cut the hole through the home floor into the crawl space. Be sure to line this hole up with the one in the hearth.
3. If you are installing your outside air vent through the wall, use a 4" hole saw or reciprocating saw to cut the hole through the wall. **BE SURE TO CHECK FOR OBSTRUCTIONS IN THE WALL.**

STEP 4: Setting the stove and connecting to the chimney

1. Assemble the stove (legs, pedestal, ash pan, blower). **Follow the installation instructions that are included in each accessory box.** Once the stove is assembled set the stove gently on the hearth using cardboard to protect the hearth.
2. Position the stove on the hearth according to the clearances shown on the diagrams in section 6. Be sure that the stove is at least minimum clearance from all combustible walls and materials. If possible it is advisable to set the stove 1-2 inches further away from the combustibles than required.
3. USING DOUBLE WALL PIPE ONLY, (single wall is not approved for a mobile home) connect the stove to the chimney. If necessary, use elbows to offset the pipe so that the stove can remain at the correct clearance and still connect to the chimney. Secure each pipe joint with three screws, using the screws provided with the pipe.
4. Drill a small hole through the hearth and route the 8 gauge copper wire into the crawl space. Use a grounding "connector" or "lug" to attach the ground wire to the stove and to the frame of the mobile home.
5. When required by local code, you will need to fasten the stove to the floor of the mobile home. To fasten a leg model, simply mark the location of the hole in the bottom of the legs, drill holes and bolt into the bottom of the leg from the crawl space. To fasten a pedestal model, holes will need to be drilled in the pedestal base. Once the holes are drilled in the base, mark the location on the floor and use bolts and nuts or lag screws to fasten.

Your stove is now ready for use. If your stove installation required a permit and requires inspection by the local building department please do not forget to call for an inspection. It is important that your permit and inspection be finalized, as some insurance companies will require the stove to be inspected. It is also a great idea to give your insurance a call and let them know that you have installed a wood stove.

PLEASE REFER TO SECTION 4-*Wood Burning Operation Instructions* before lighting your first fire.

Section 3 – Residential installation

INSTALL AND USE IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION AND OPERATING INSTRUCTIONS ONLY. WHILE MOST ANYONE WITH BASIC CARPENTRY SKILLS CAN SUCCESSFULLY AND SAFELY INSTALL THEIR KUMA WOOD STOVE, IT IS HIGHLY RECOMMENDED THAT IT IS INSTALLED BY A QUALIFIED PROFESSIONAL WHO IS PROPERLY TRAINED AND LICENSED–PREFERABLY AN NFI CERTIFIED (NATIONAL FIREPLACE INSTITUE) EXPERT.

CAUTION: The Structural integrity of the floor, walls and ceiling/roof must be maintained. Use additional bracing if required. Never cut a load bearing wall or engineered truss. Use elbows if necessary to offset the pipe.

CAUTION: NEVER INSTALL A STOVE IN A SLEEPING ROOM.

STEP 1:Make sure you have the proper tools, materials, and stove components.

Tools:

1. Reciprocating Saw
2. Assorted Screwdrivers
3. Measuring Tape
4. Pencil
5. Plumb Line
6. Electric or Cordless Drill with assorted drill and driver bits
7. Tin Shears
8. Utility Knife
9. Pliers
10. Hammer
11. Assorted Wrenches

Materials:

1. Caulking to seal roof flashing and storm collar. High temperature silicone is recommended.
2. Assorted heavy duty nails and screws.
3. Short pieces of 2x4 or 2x6. Two pieces minimum 24" long.

Stove Components: Each component has installation instrucions included. (See section 8 for a complete list of accessories.)

1. Stove body (K-ASH)
2. Pedestal or leg kit (KA-ASHPED, KA-WLEGSTEEL, etc.)
3. Door Kit (DOOR2CASTC, DOOR2GOLDC, etc.)
4. Outside air kit (KA-OUTSIDEAIR) Outside air is only required for manufactured homes. Check your local building codes

Determining the stove location:

When choosing a stove location there are a few things that should be considered.

1. Try to choose a location that is centrally located in the house.
2. Try to choose a location that will be easy to access from your wood storage area.
3. Survey the roof area above and around the location of the chimney exit. Be sure there are no dormers, roof valleys or any other roof irregularities that could cause difficulty when trying to set and seal the roof flashing.

4. If possible, survey the attic area above and around the location of the chimney. Be sure there are no major obstructions such as plumbing, heating ducts, electrical wires, phone cables, etc. Also check the crawl space below and around the stove location for the same obstructions.

STEP 2: Installing the chimney.

Use only 6" Class A solid fuel chimney that has been U.L. Safety tested for wood stoves.

IMPORTANT: These instructions are a very basic guideline for the steps to install your chimney. For complete instructions, refer to the installation manual that came with your chimney. Chimney installation instructions are usually located in the box with the chimney cap or chimney support components. DO NOT mix different brands of chimney components. If you have any questions about the installation of your chimney, please contact the dealer where you purchased your stove.

CAUTION: Inspect all chimney components for damage. Do not use any damaged chimney components.

Installing the chimney – Continued

1. Familiarize yourself with the clearances of the stove for the configuration in which you have chosen to install i.e. corner installation or straight wall installation (see section 6). Notice the clearances listed for the chimney, this will help you determine the location of the hole in the ceiling.
2. Once you've determined the hole location for the chimney, use a drywall saw or reciprocating saw to cut the ceiling to the desired hole size. <u>BE SURE TO CHECK FOR OBSTRUCTIONS BEFORE CUTTING THE HOLE, REFER TO PIPE INSTALLATION INSTRUCTIONS FOR HOLE SIZE.</u>
3. Use a plumb to transfer the ceiling hole center to the underside of the roof sheeting in the attic. Once you've marked the hole center on the roof sheeting, drill a hole from the inside or poke a screw or nail through the sheeting so you can find that location once you're on the roof.
4. **<u>Always be careful when using a ladder and working on a roof. Have someone hold the ladder for you while you are climbing up and down. Use a positioning belt or harness and safety rope to secure yourself on the roof.</u>** Locate the hole or screw/nail on the roof that you poked through from the attic. Lay the roof flashing down and center over the hole, screw or nail. Using a pencil, trace the inside of the flashing cone onto the roof. Remove the flashing and use a reciprocating saw to cut out the hole. **Cut the hole out about 1" larger than the mark all the way around.**
5. Use the two pieces of 2x4 or 2x6 to brace across the trusses in the attic. Position the bracing in a way that you will be able to attach the chimney support with the proper clearance to the bracing (see chimney installation instructions for proper clearances). Attach the chimney support to the bracing using screws or nails.
6. Using a flat pry bar, gently lift the shingles off the roof from the middle of the hole up. Slide the flashing up under the shingles on the top half of the hole and let the flashing sit on top of the shingles on the bottom half of the hole. Use silicone or roof tar to seal underneath the flashing and use screws or nails to fasten the flashing to the roof. Be sure to apply a small amount of sealer to each screw head.
7. Slide the first section of chimney through the flashing and into the chimney support. Chimney supports vary from one brand of pipe to another, be sure that the first section of pipe is well secured into the chimney support, again, paying close attention to the chimney manufacturers installation instructions.
8. Continue to fasten chimney sections above the first one until the correct height is reached (see pipe installation instructions)
9. Install the chimney cap
10. Install the storm collar above the flashing and use high temp silicone to seal.
11. If necessary, install a roof brace or guy wires to steady the chimney. Bracing is usually required if the chimney extends more that five feet above the roof.

STEP 3: Installing the hearth and outside air vent

OUTSIDE AIR IS REQUIRED FOR MOBILE HOMES ONLY but may be used if desired.

1. The hearth must be a minimum 3/8" thick non-combustible material and must extend beyond the base of the stove 6" to the sides and back and 16" to the front (section 6)
2. **When building a hearth pad on site, be sure to leave an area open for the installation of the outside air vent.** Once the hearth is positioned according to the minimum clearances, locate and mark out for the 4" outside are vent. On a pedestal model stove, this hole may be anywhere under the stove base. On a leg model stove, try and locate the hole to line up with the hole in the bottom of the stove. On a pre-manufactured hearth, use a hole saw or circular saw to cut through just the backing board then use a hammer and firmly hit the tile or stone on the top side. If the backing board was cut to the correct depth, the tile or stone will break out very clean. Also using a hole saw or circular saw cut the hole through the home floor into the crawl space. Be sure to line this hole up with the one in the hearth.
3. If you are installing your outside air vent through the wall, use a 4" hole saw or reciprocating saw to cut the hole through the wall. **BE SURE TO CHECK FOR OBSTRUCTIONS IN THE WALL.**

STEP 4: Setting the stove and connecting to the chimney

6. Attach the legs or pedestal to the stove following the instructions provided in the box with them. Once the legs or pedestal is attached, set the stove gently on the hearth using cardboard to protect the hearth. (If using cast or plated legs you must use leg spacer part# KA-WCLSK)
1. Position the stove on the hearth according to the clearances shown on the diagrams in section 6. Be sure that the stove is at least minimum clearance from all combustible walls and materials. If possible it is advisable to set the stove 1-2 inches further away from the combustibles than required.
2. Using double wall or single wall stove pipe, connect the stove to the chimney. We recommend using double wall pipe regardless of pipe clearance; however, single wall pipe is approved for use. If necessary, use elbows to offset the pipe so that the stove can remain at the correct clearance and still connect to the chimney. Secure each pipe joint with three screws, using the screws provided with the pipe. Be sure to follow the clearance diagrams in section 6 pertaining to the correct pipe, single or double wall. Single wall pipe has a minimum clearance of 18" and double wall a minimum clearance of 8"

Your stove is now ready for use. If your stove installation required a permit and requires inspection by the local building department please do not forget to call for inspection. It is important that your permit and inspection be finalized, as some insurance companies will require the stove to be inspected. It is also a great idea to give your insurance a call and let them know that you have installed a wood stove.

PLEASE REFER TO SECTION 4-*Wood Burning Operation Instructions* before lighting your first fire.

Section 4 – Wood burning operation instructions

IMPORTANT:
Your new KUMA wood stove is shipped with a baffle packing to eliminate damage in shipping. Once the stove is set in place and ready to use you will need to remove the baffle restraints. To remove the baffle restraints, cut the ties in front of the nylon buckle and pull forward on the bottom cable until it pulls out. Remove the two cardboard pieces from on top of the baffle and discard. Be careful not to dislodge or damage the ceramic wool blanket on top of the bricks. Your stove is now ready for operation.

CAUTION:
When building the first couple of fires, be careful to build the fire small and increase the heat slowly over a 4-5 hour period. The paint on the stove "cures" with heat and needs to be done slowly. As the paint "cures" it gives off a smell and even sometimes a visible "smoky" haze into the room. Make sure the area is well ventilated during the curing operation. The smell will disappear after a few hours of operation.

A word about draft.
The principle of draft is that warm air rises. Your chimney provides draft which sucks the smoke up the chimney. The stove does not "push" out the smoke. Your Wood Classic stove has been designed and approved for use under normal conditions. Unacceptable smoking usually indicates poor draft in your chimney system.

Reccomendations on building and maintaining a fire.
Start by opening the air control on the stove to fully open. Fully open, depending on the model, will be pulled all the way out to the left, pulled all the way forward, or in the case of the largest stove, the two vents near the bottom will be pushed towards the center.
NEVER USE FLAMIBLE LIQUIDS TO START OR FRESHEN UP A FIRE.
Using a good firestarter can make lighting a fire much easier. There are several different types of firestarter available in "chips" "nuggets" and gels. Newspaper also makes a good fire starter if it is torn into strips. When building a fire, use plenty of fire starter on the bottom and use small kindling directly on top of that. Use progressivly larger pieces as you stack wood all the way to the top of the firebox. When starting a fire you should never use unsplit pieces of wood unless they are small such as twigs and branches.
Once the wood is stacked in the firebox, you may light the fire starter and leave the door slightly cracked open for a few minutes to aid in the start up of your stove. Once the fire is well lit, shut the door, but leave the air control in the open position for about 20-30 minutes. After burning for about a half an hour in the open position, you can start to regulate the heat output and burn rate by shutting the air control down. Remember to let your stove burn open for 20-30 minutes each time you reload it with wood. Shutting the air control prematurely can cause excessive creosote in the chimney. Use the following as a general guideline for desired burn rates.

Low burn	Draft handle pushed all the way in
Med-Low burn	Draft handle pulled out approximately 1/8" – ¼"
Medium burn	Draft handle pulled out approximately ¼" – ½"
Med-High burn	Draft handle pulled out approximately ½" – 1"
High burn	Draft handle pulled out all the way

Additional instructions and information.

1. Build your fires directly on the firebrick. Using a grate will allow too much air to the coal bed and will result in incomplete combustion of the wood. Using a grate can also leave charred pieces of wood after the fire has gone out.
2. Use only the best grade of dry wood available. Wood should be seasoned for 1 full year prior to being used. Split wood will season much faster and better that wood left in the rounds. Burning green or wet wood greatly increases the chance of creosote build up and produces significantly less heat. **The number 1 cause for creosote build up is moisture in the wood.** Store your wood

in a dry location. Any wood stored near the stove needs to maintain proper clearance from the stove.

3. Small hot fires produce less creosote than long, low smoldering fires. When you start your stove or are re-kindling (reloading) your wood stove with a full or sizeable load of wood, open the draft fully and burn the stove at full burn for 20-30 minutes to heat up the chimney and secondary burn system. This ensures that when the draft control is pushed in for a lower, longer burn, the stove will burn cleaner. You should notice more upper firebox flame activity. This is smoke from the wood mixing with pre-heated air and burning. This is called secondary burn and results in higher stove temperature at lower burn rates and less soot and creosote build-up. Just after starting the fire, some smoke may occur until the chimney warms up to produce some draft. During normal operation, adjust the draft to the position required. If properly set, it will assure longest burn times and the most even heat cycle. Larger loads of wood will create the longest burn times.

Optional blower operation instructions

To install the blower, follow the instructions packaged with the blower. Plug the blower into the nearest 115V grounded circuit. Turn the variable speed knob to 'click' onto high speed. As the knob is turned clock-wise, the blower speed decreases to your desired speed. The blower speed should match the desired burn rate on your stove: i.e. low-burn rate...low blower speed; high-burn rate... high blower speed and so forth.

Ash Pan Operating Instructions:

Safety Precautions

1. Do not operate your wood stove with the ash pan open or removed.
2. Empty the ash pan when the fire is at its lowest point or out.
3. NEVER empty ashes into a combustible container (paper bag, plastic bucket, etc.)
4. NEVER leave ashes in the house or garage. Ashes that seem to be cool may not be.
5. Check gasket on ash pan periodically to ensure a good seal.

Operation

1. Wait until the fire is at its lowest point or out.
2. Remove the ash pan by turning the handle and pulling out.
3. Take the ash pan outside and dump the ashes into a metal or other non-combustible container.
4. Before replacing the ash pan, check to see if any ashes need to be removed from the ash pan plenum. If any significant amount of ashes remain in the ash plenum, it will prevent the ash pan from sliding all the way in and it may not seal, resulting in air entering the ash grate which will produce a runaway fire.
5. Replace the ash pan by inserting it back into the stove, pushing in on the handle while in the horizontal position, and turning to the straight up and down position (spring pointed down).

Section 5 – Maintenance

Use the table below as a general maintenance schedule for your stove. See below the table for detailed information on performing the maintenance.

Ash disposal	Every 1-2 weeks
Chimney inspection and cleaning	Every 2-3 months
Gasket replacement	Every year or as needed
Glass cleaning and replacement	As needed
Brick replacement	Replace broken bricks as needed
Clean and inspect stove	Every year
Replace ceramic insulation	Every year or as needed

Ash disposal – Every 1-2 weeks

1. Empty the ash pan when the fire is out. Never try to empty the ash pan when the stove has an active or full fire, doing so will over heat the stove.
2. Using gloves, remove the ash pan by turning the handle to one side or the other and pulling straight out.
3. Dump the ashes into a non-combustible container away from the house. <u>NEVER EMPTY ASHES INTO A COMBUSTIBLE CONTAINER SUCH AS A PLASTIC BUCKET OR PAPER BAG. NEVER LEAVE ASHES IN THE HOUSE OR GARAGE.</u>
4. Before replacing the ash pan, check to see if any ashes need to be removed from the ash pan plenum. If any ashes remain in the ash plenum it will prevent the ash pan from sliding all the way in and it may not seal, resulting in air entering the ash grate which will produce a runaway fire.
5. Replace the ash pan by inserting it back into the stove, pushing in on the handle while in a horizontal position, and turning the handle vertically (spring towards the bottom).

Chimney inspection and cleaning – Every 2-3 months

1. Refer to the chimney manufacturers installation instructions for additional information on cleaning the chimney. We recommend having the chimney cleaned by a licensed professional chimney sweep.
2. When wood is burned, it releases tar and other organic vapors. When these vapors combine with moisture, creosote is formed and enters the chimney. When the stove is burning on a low setting, the exhaust can be moving slow and the chimney can be relatively cool. This combination of slow exhaust and a cool chimney causes creosote to stick to the walls of the chimney. When creosote accumulates, it causes the draft to slow and the problem of creosote accumulation will compound. If the creosote is not removed on a regular basis, a chimney fire can occur which can damage the chimney and/or stove. Therefore, the importance of regular chimney maintenance cannot be emphasized enough.

Gasket Replacement – **Every year or as needed**

1. Gaskets need to be checked at least once a year. The gaskets on your stove are designed to keep unwanted air out of the firebox. Neglecting these gaskets can cause a decrease in burn times, more wood consumption and possible over heating of the stove. When checking the gaskets, look for wear areas that show fraying or cutting. Check the gasket for softness by pressing them with your finger and give a slight tug on one area to see if the glue is still holding. Gaskets that are cut or fraying can cause small air leaks in that spot. Gaskets that are hard will not conform to the stove and may leak air. Gaskets that are not held in with glue could come out at an inconvenient time. The gaskets that need to be checked are: Door gasket, ash pan gasket, and glass gasket. Refer to section 8 for part numbers for the correct gasket for your stove and check with your dealer for parts availability.

Glass cleaning and replacement – as needed

1. Never clean the glass when it is hot.

2. Clean the glass with an approved stove glass cleaner, never use an abbrasive material like sandpaper or steel wool
3. Your stove is equipped with an airwash system that will self-clean the glass. If the glass is black or covered with soot from slow burning, simply load the stove with good, dry, split wood and burn at high burn for about 20- 30 minutes and the glass should burn clean.
4. Never build a fire against the glass.
5. When closing the door be sure that no pieces of wood are protruding from the door opening that could touch the glass. Excessive stress like closing the door on a piece of wood will break the glass. If the glass ever breaks in your stove, don't panic, simply shut the air off and let the fire burn out. Do not continue to operate a stove with broken glass. Do not leave the stove unattended with broken glass.
6. To replace the glass it may be helpful to remove the door from the stove and place on a clean soft work area. Remove the retaining ring screws and retaining ring, remove the glass and dispose of properly, CAUTION: BROKEN GLASS WILL BE SHARP. Clean the door thoroughly where the new piece of glass will install. Set the new piece of glass into the door and replace the retaining ring and screws. Be careful to tighten the screws evenly, uneven pressure can break the glass. Tighten the screws just enough to hold the glass firmly, overtightening can cause uneven pressure and can break the glass.

Brick replacement – As needed

1. Bricks should be inspected and replaced if necessary at least once a year. Cracked bricks are fine as long as they remain in place. Some of the bricks inside your stove are interchangeable, so shuffling bricks around can be done, for example, a baffle brick that is broken and will not stay in place can be swapped with a brick on the firebox bottom.

Clean and inspect stove – Every year

1. Your stove should be fully cleaned and inspected once a year. This is a great time to inspect the bricks, gaskets, ceramic blanket and the rest of the stove for signs of abnormal wear. Start by shoveling all the ashes out of the stove and emptying the ash pan. Use a shop vac to clean the hard to reach places. Look at the inside of the stove for signs of wear, paying close attention to the stainless steel baffle brick holders and burn tubes. Discoloration of the stainless steel is normal as is slight sagging. If either of the brick holders is failing to keep the bricks in place then it should be replaced.

Replace ceramic insulation – Every year or as needed

1. At least once a year, check the ceramic insulation on top of the baffle in your stove. The ceramic insulation is designed to keep heat in the stove and increase efficiency. As long as the insulation is in place it can be left alone. If the insulation becomes torn during cleaning, simply lay it back together tightly in that area. If the insualtion tears to multiple pieces, it should be replaced, smaller pieces can become caught in the draft and cause a resriction.

Section 6 – Clearances and diagrams

Figure #1 Double Wall Pipe
Use this diagram for the following installations:

1. Mobile Home installation with the stove in a corner using double wall pipe.
2. Residential installation with the stove in a corner using double wall pipe. For single wall pipe, refer to figure 2.

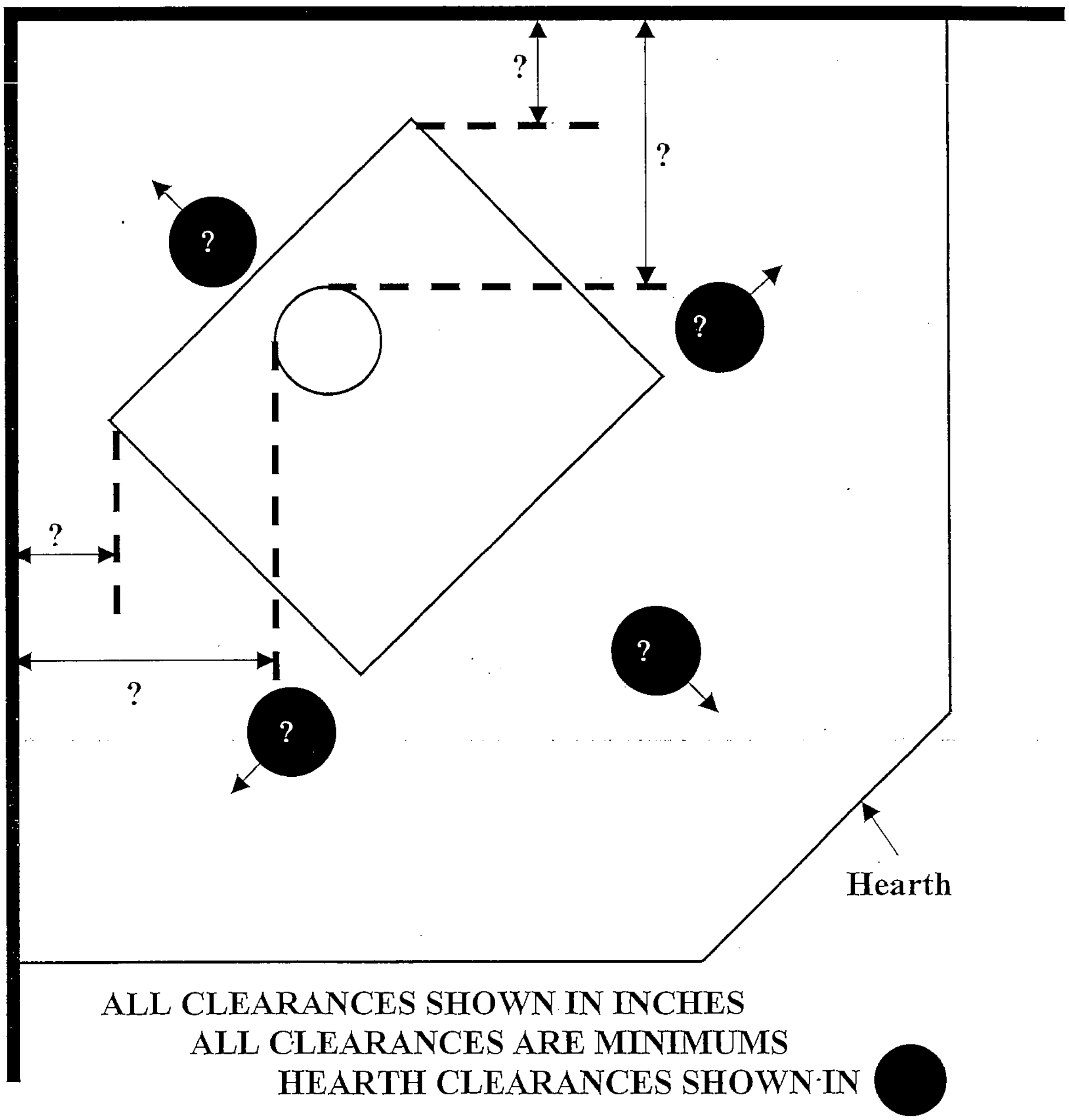


Figure #2 Single Wall Pipe

Use this diagram for the following installation:

1. Residential installation with the stove in a corner using single wall pipe. For double wall pipe, refer to figure 1. For mobile home installation in a corner, refer to figure 1

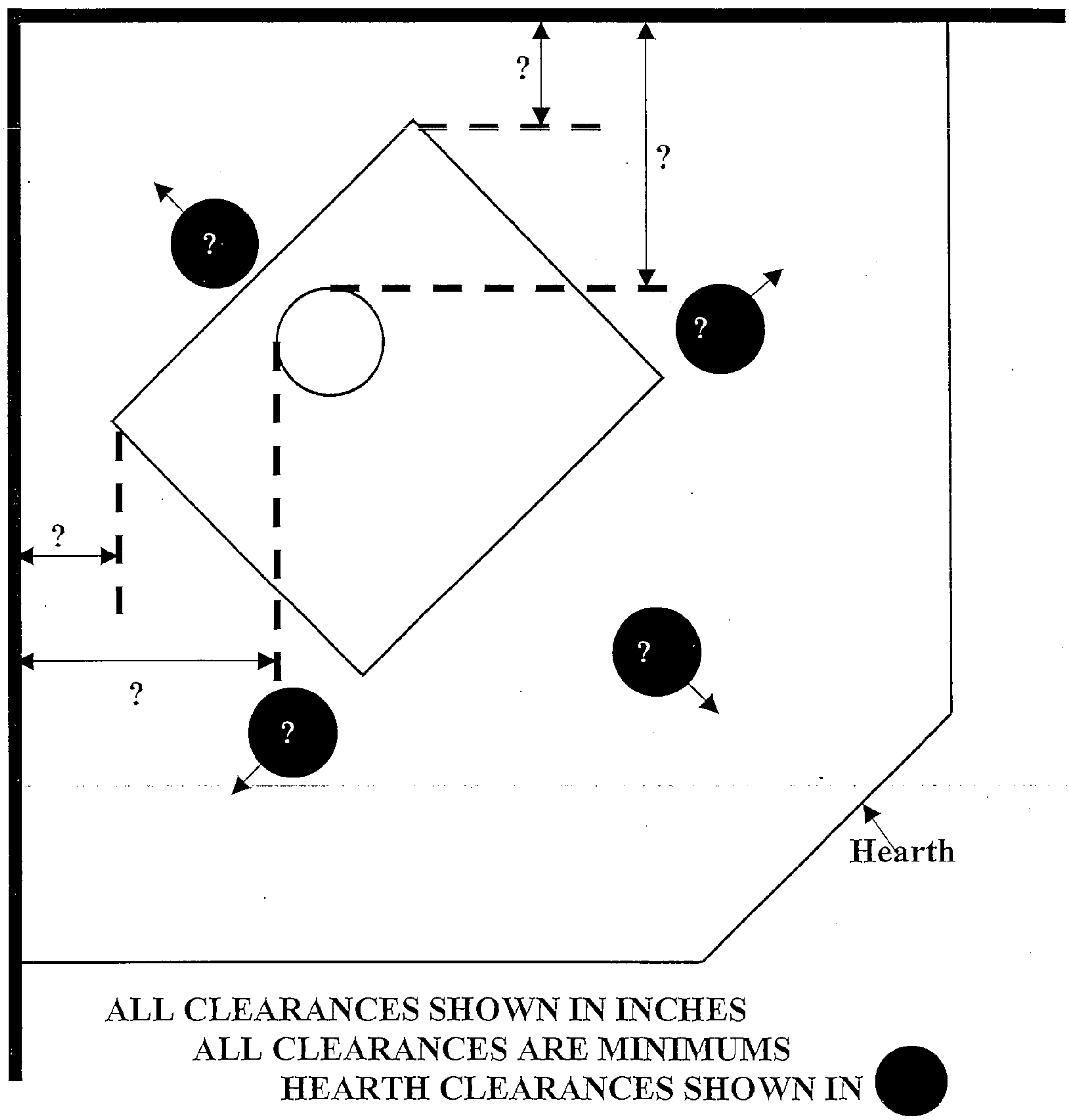


Figure #3 Double Wall Pipe

Use this diagram for the following installations:

1. Mobile home installation with the stove on a straight wall using double wall pipe.
2. Residential installation with the stove on a sraight wall using double wall pipe. For single wall pipe, refer to figure 4.

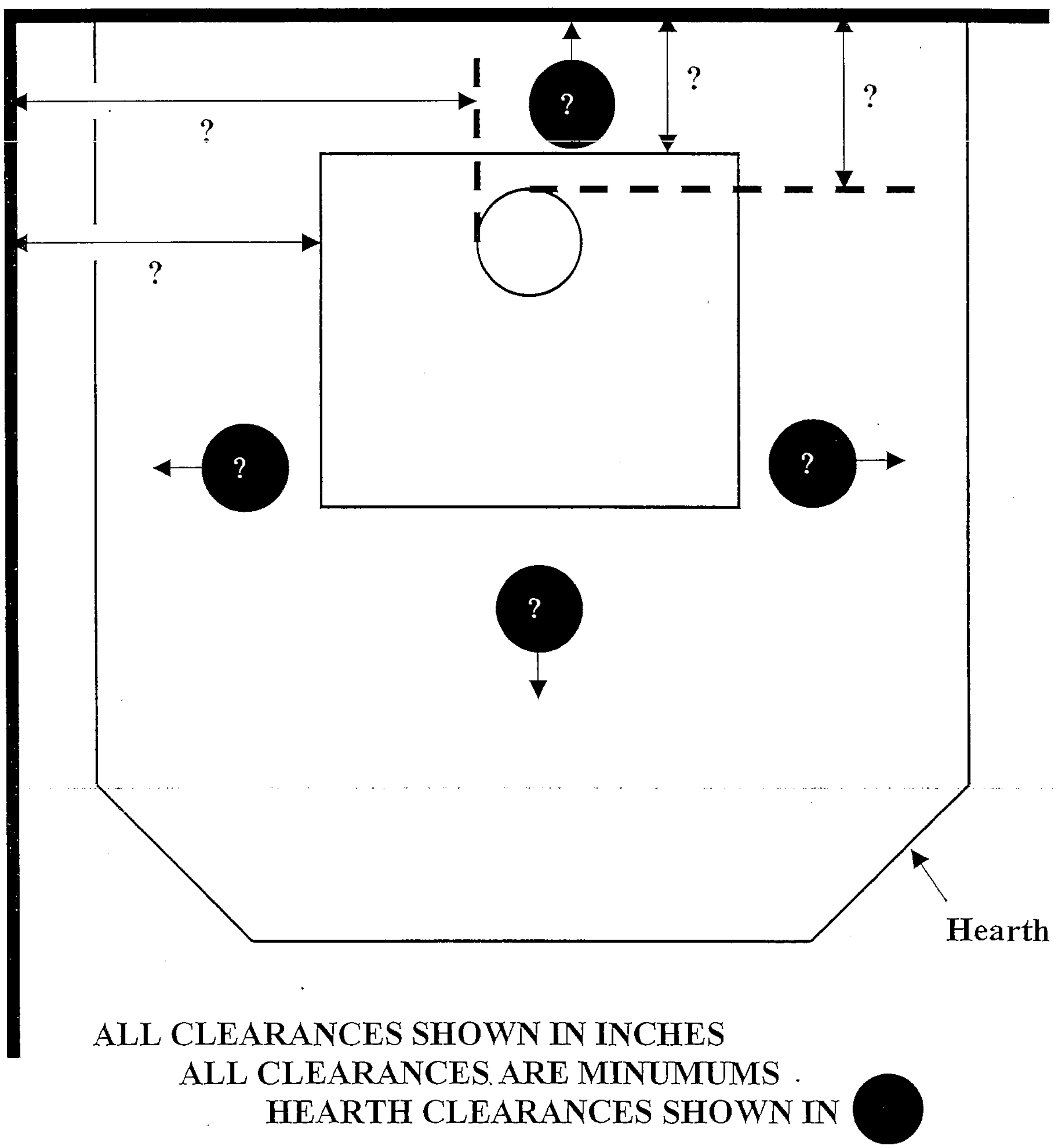
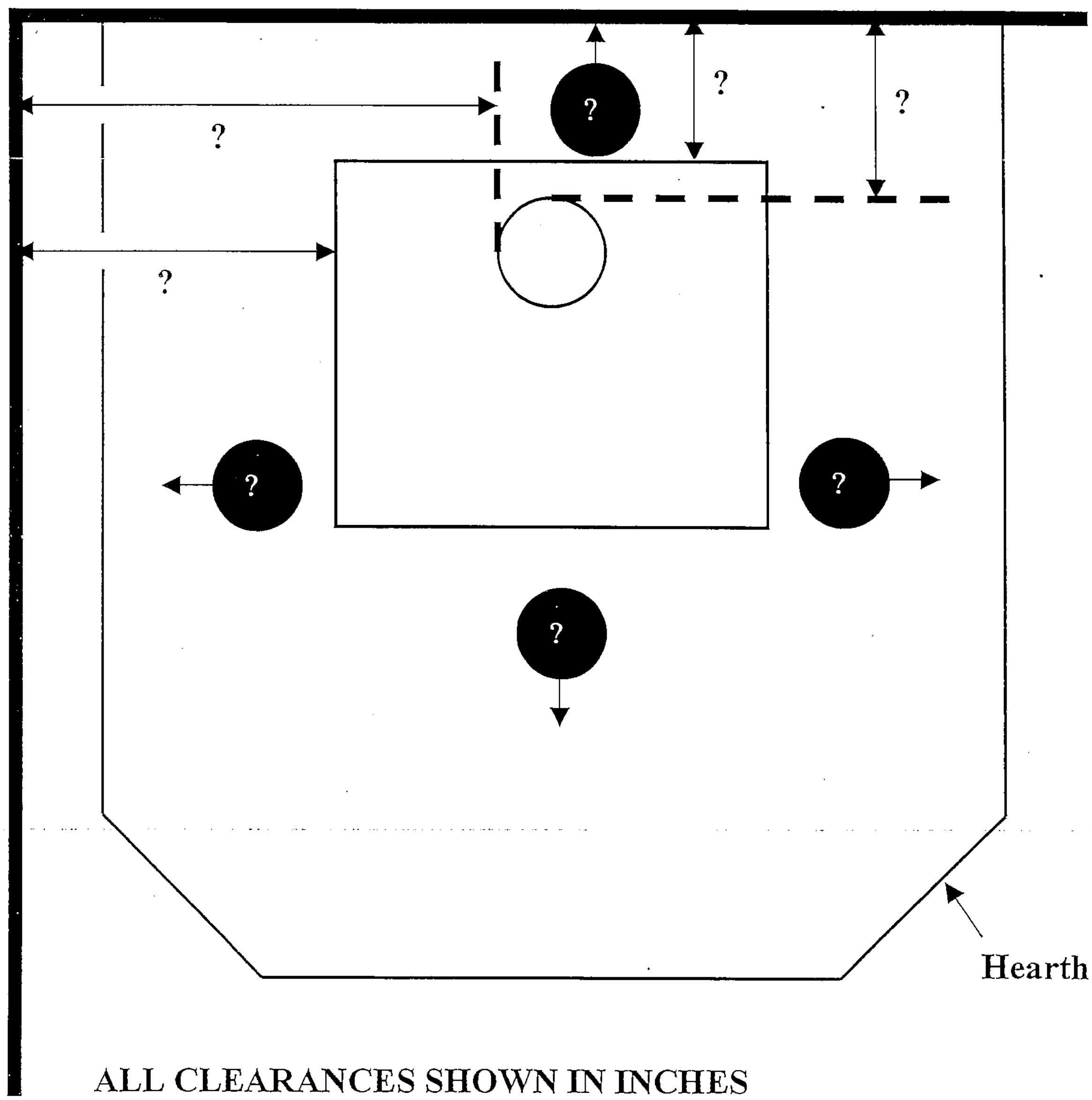


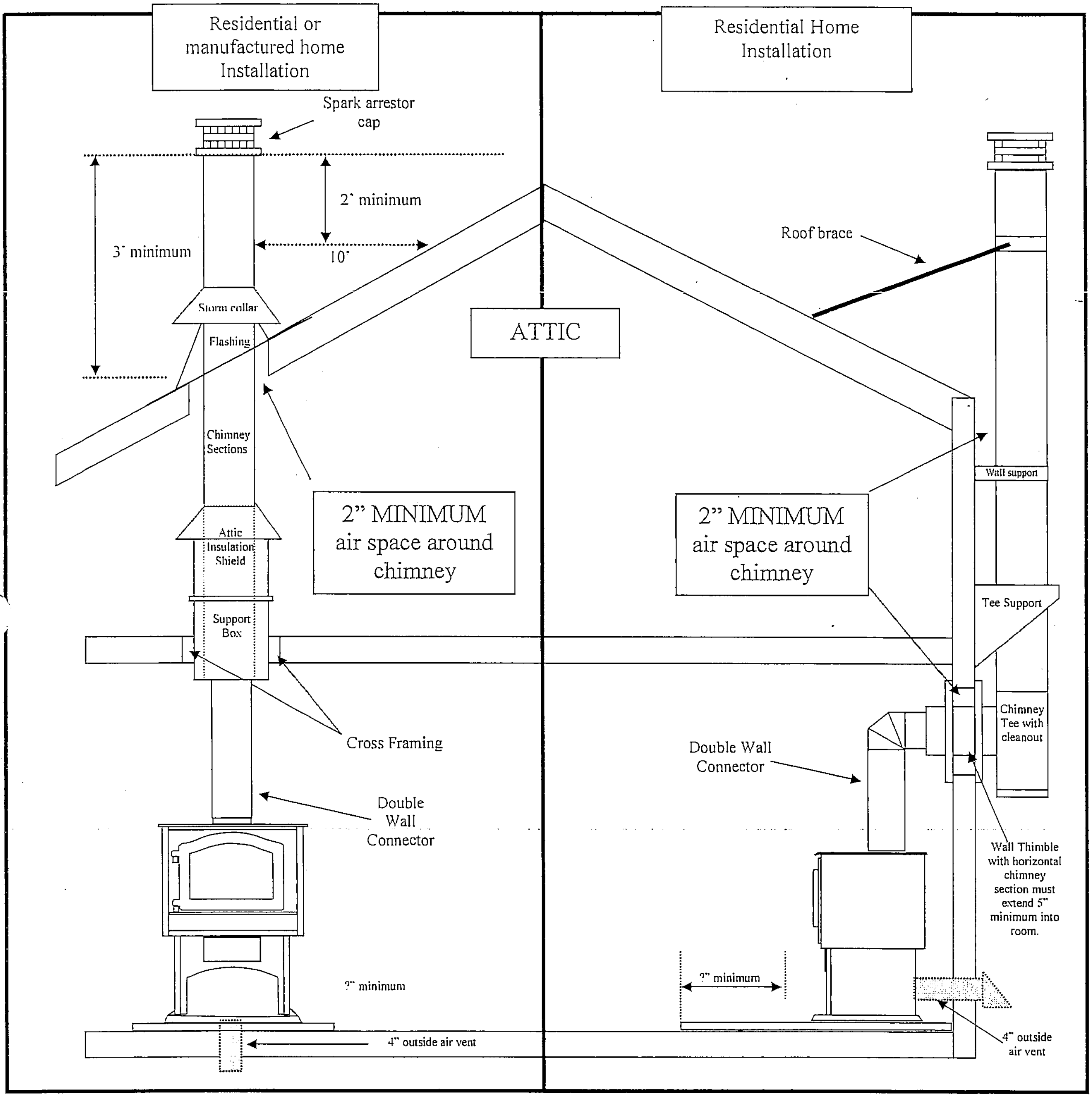
Figure #4 Single Wall Pipe
Use this diagram for the following installations:

1. Residential installation with the stove on a stright wall using single wall pipe. For double wall pipe. refer to figure 3. For mobile home installation on a straight wall refer, to figure 3.



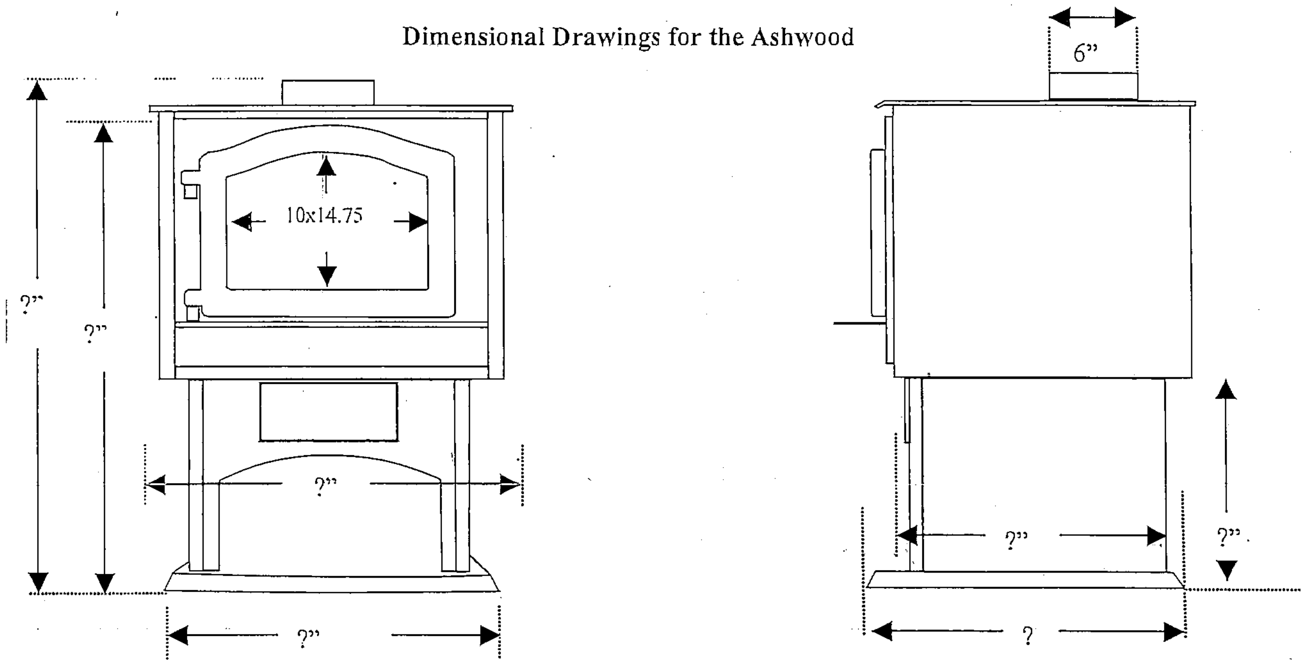
ALL CLEARANCES SHOWN IN INCHES
ALL CLEARANCES ARE MINIMUMS
HEARTH CLEARANCES SHOWN IN ●

Ashwood Installation diagram for manufactured chimneys
NEVER INSTALL A WOOD STOVE IN A SLEEPING ROOM

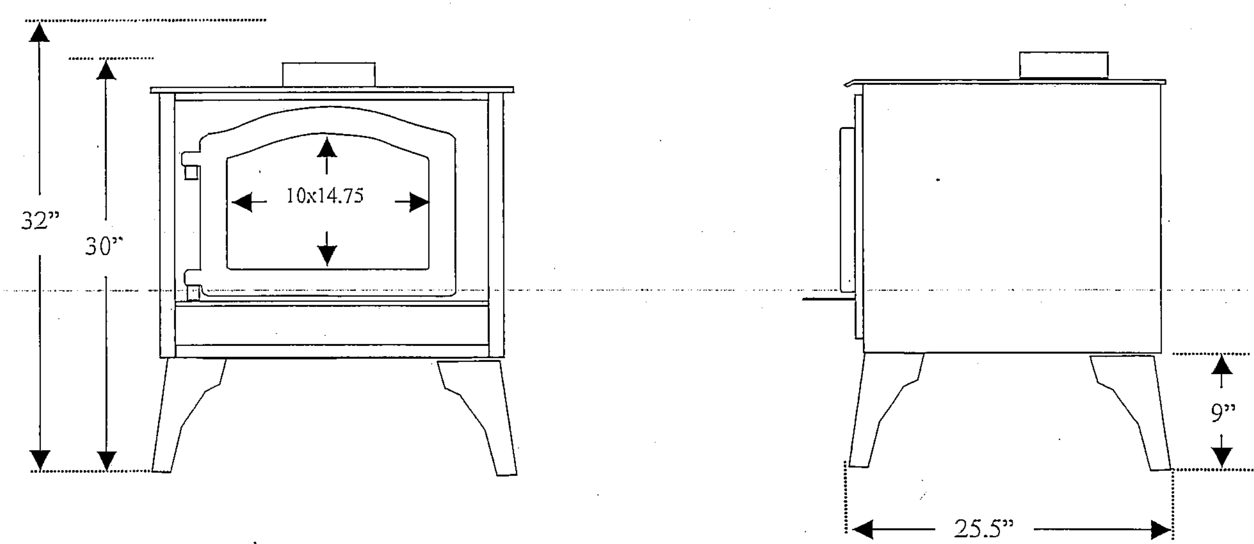


These diagrams are for manufactured chimneys. For Brick Chimneys a safety listed thimble must be used when a connection is made through a combustible wall to a lined masonry chimney. This stove may be connected to a lined masonry chimney or a listed factory built chimney designed for use with solid fuels and conforming to, Canadian ULC629 or USA UL-103HT . Clearances to combustibles must be maintained per manufacturer's instructions on chimney pipe , and stove pipe connectors. Use only double-wall connector in mobile homes

Dimensional Drawings for the Ashwood



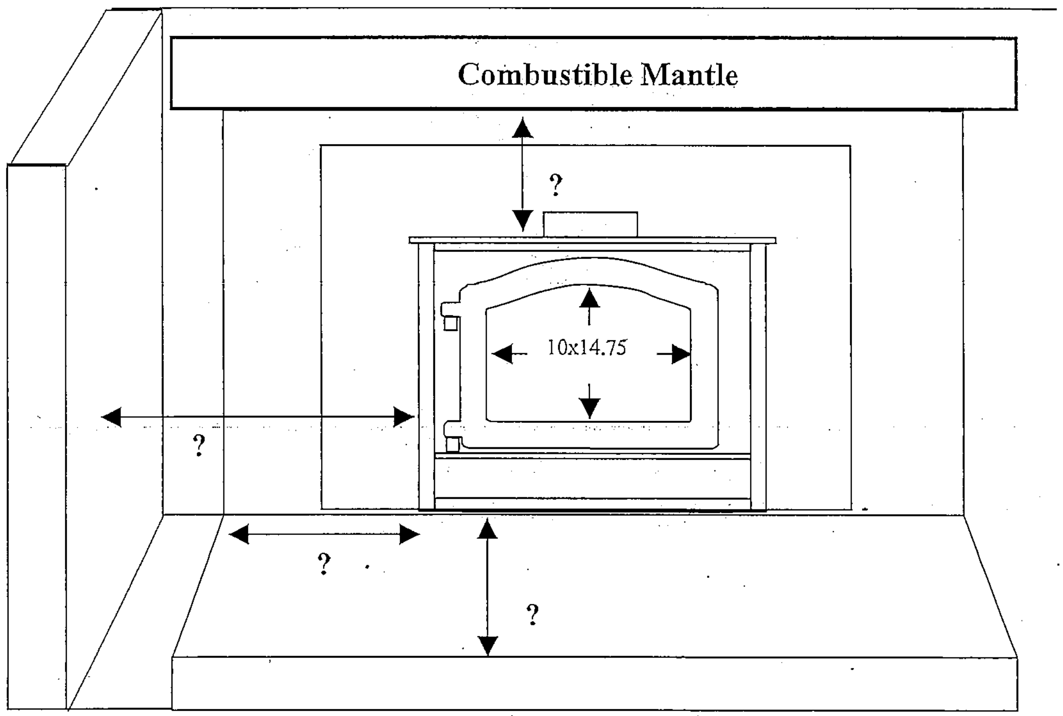
Ashwood Pedestal (K-ASH + KA-ASHPED)

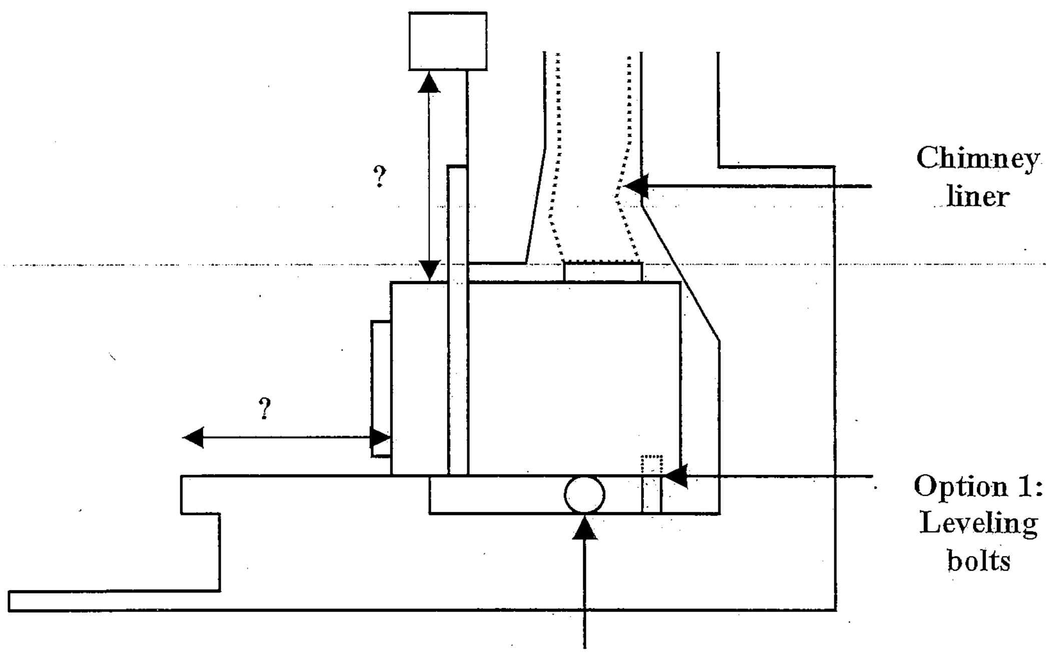


Wood Classic Leg (K-WC + KA-WLEGSTEEL)

Figure #5 Insert

Use this diagram for the following installations:1.Installation into a masonry fireplace





Section 7 – Trouble Shooting

1. Stove burns lazy at start up.
2. Stove back-puffs or smokes into the room at start up.
3. Stove smokes out the door when it is open.
4. Stove won't shut down.
5. Stove won't burn hot enough. Lazy burn.
6. Burn time too short.

Stove burns lazy at start up. return to top

1. The chimney is still cool, allow more time to warm up.
2. Wood is not seasoned (still green). Wood should sit for about 1 year, split and loosely stacked if it was cut green.
3. Wood is well seasoned but has a lot of surface moisture. Your wood supply must be covered. Check your tarps or other covering to see that no rain or snow is getting to your wood. Wood should be covered on top, but open on the sides to allow air movement to aid in drying.
4. Check the air supply to the stove. If you have installed outside air, check the ducts for blockage. If you are not using outside air, be sure you have removed the cover plate on the back of the pedestal. (pedestal models only)

Stove back-puffs or smokes into the room at start up. return to top

1. Chimney is cold. Cold chimneys can produce a "reverse draft" where cold air is rushing down the chimney into the stove. Open a door or a window for about 5 minutes to equalize pressure in the house then try restarting with small strips of newspaper. Using small strips of newspaper or an approved fast burning firestarter and small pieces of kindling will create heat faster to help reverse the cold air.
2. Chimney and/or the chimney cap needs to be cleaned. Your chimney should be checked and cleaned if necessary every few months. Even a small amount of build up can cause a draft restriction, for example: ¼ inch of build up on the side wall of a 6" chimney reduces the effective area of the chimney by about 20%. Pay close attention to the chimney cap, especially if it has a screen. Screened chimney caps can become blocked enough to restrict flow in just a few weeks.

Stove smokes out the door when it is open. return to top

1. The door was opened too quickly. Crack the door open just a small amount and let the stove "breathe" a few seconds before opening all the way.
2. Chimney and/or the chimney cap needs to be cleaned. Your chimney should be checked and cleaned if necessary every few months. Even a small amount of build up can cause a draft restriction, for example: ¼ inch of build up on the side wall of a 6" chimney reduces the effective area of the chimney by about 20%. Pay close attention to the chimney cap, especially if it has a screen. Screened chimney caps can become blocked enough to restrict flow in just a few weeks.

Stove won't shut down. return to top

1. The ash pan may not be sealing correctly (pedestal model). Check the ash pan gasket for tearing or fraying. See the ash pan instructions in section 5. Even a small amount of undesired air can keep the stove from shutting down.
2. Check the main door gasket and glass gasket for proper seal. See section 5 for instructions on checking your gaskets.

Stove won't burn hot enough. Lazy burn. return to top

1. Wood is not seasoned (still green). Wood should sit for about 1 year, split and loosely stacked if it was cut green.

2. Wood is well seasoned but has a lot of surface moisture. Your wood supply must be covered. Check your tarps or other covering to see that no rain or snow is getting to your wood. Wood should be covered on top, but open on the sides to allow air movement to aid in drying.
3. Chimney and/or the chimney cap needs to be cleaned. Your chimney should be checked and cleaned if necessary every few months. Even a small amount of build up can cause a draft restriction, for example: ¼ inch of build up on the side wall of a 6" chimney reduces the effective area of the chimney by about 20%. Pay close attention to the chimney cap, especially if it has a screen. Screened chimney caps can become blocked enough to restrict flow in just a few weeks.
4. Check the air supply to the stove. If you have installed outside air, check the ducts for blockage. If you are not using outside air, be sure ou have removed the cover plate on the back of the pedestal. (pedestal models only)

5. Atmospheric conditions. Occasionally, barometric episodes occer that affect draft, thereby affecting stove performance. If your stove has been working fine and performance drops suddenly, this is most likely the cause, and will usually go away within a few days.
6. Your fuel load may be too small or the wood size too large for the coal bed. A small bed of coals requires re-kindling to build up the heat, only put large chunks of wood on a very hot and active bed of coals.

Burn time too short. return to top

1. Your fuel load may be too small or the wood size too large for the coal bed. A small bed of coals requires re-kindling to build up the heat, only put large chunks of wood on a very hot and active bed of coals. If there are large chunks of charred wood left after the fire has gone out, the coal bed was not hot enough.
2. Fuel quality. Harder, denser woods produce longer burn times. Likewise, softer woods produce shorter burn times.
3. The ash pan may not be sealing correctly. Check the ash pan gasket for tearing or fraying. See the ash pan instructions in section 5. Even a small amount of undesired air can keep the stove from shutting down.
4. Check the main door gasket and glass gasket for proper seal. See section 5 for instructions on checking your gaskets.

Section 8 – Accessories and Parts

Accessories

1. KA-BLOWER2- Stove blower.
2. KA-OUTSIDEAIR- Outside air kit.
3. KA-WLEGSTEEL- Black steel leg set.
4. KA-WLEGCAST- Black cast iron leg set.
5. KA-WLEGGOLD- Gold plated leg set.
6. KA-WLEGPEWTER- Pewter plated leg set.
7. KA-WCPED- Pedestal kit (includes ash pan)
8. KA-SUNBURST1BLK- Decorative window sunburst, painted black.
9. KA-DOOR2CASTC- Complete black door. Includes: Glass, glass holder, gaskets, door handle and door pins.
10. KA-DOOR2GOLDC- Complete gold door. Includes: Glass, glass holder, gaskets, door handle and door pins.
11. KA-DOOR2PEWTERC- Complete pewter door. Includes: Glass, glass holder, gaskets, door handle and door pins.

Parts

1. KR-ASHGRATE- Replacement ash grate

2. KR-ASHPANGASK- Replacement ash pan gasket, includes glue.
3. KR-BRICK- Replacement firebrick.
4. KR-DOORGASKET- Replacement door gasket, includes glue.
5. KR-GLASS2- Replacement glass, includes gasket.
6. KR-GLASSGASKET- Replacement glass gasket
7. KR-ASHBURNTUBE1- Front baffle burn tube.
8. KR-ASHBURNTUBE2- Middle-front baffle burn tube.
9. KR-ASHBURNTUBE3- Middle-rear baffle burn tube.
10. KR-ASHBURNTUBE4- Rear baffle burn tube.
11. KR-ASHINSULATION- Ceramic baffle insulation.
12. KR-ASHBAFFLE- Ceramic baffle board

Section 9 – Warranty and warranty registration

For all warranties, please contact the dealer where you purchased your stove. Kuma Stoves will not warranty defective products directly to the consumer.

THE WARRANTY ON YOUR NEW KUMA STOVE IS AS FOLLOWS:

Lifetime warranty:

All welded steel components including but not limited to: Firebox, top plate, convection shell, stove base, ash drawer, firebrick holders, air plenums and ash plenum.

5 year warranty:

All stainless steel baffle components including: Front and rear baffle brick holders and secondary burn tubes. All cast iron components including: Door casting (does not include gold or pewter plating) and ash grate.

1 year warranty:

Stove blower (if equipped).

30 day warranty:

Gold or pewter plating including the plating on the stove door or sunburst. Gold and pewter is warranted against chipping/flaking only, NOT tarnishing or scratching. Glass is warranted for 30 days against single line cracking, NOT multiple line or "spider web" cracking. Paint is warranted against flaking/bubbling only, NOT scratching or discoloration.

NOT WARRANTED:

Including but not limited to: Firebrick, ceramic insulation, door gasket, glass gasket and ash pan gasket.

This warranty does not apply in cases of abuse, mishandling, unauthorized repair, alterations, misuse, accident, misapplication, improper installation, improper maintenance and/or service. Kuma Stoves reserves the right, under this warranty, to replace, repair or authorize repair of the defetctive product at it's sole discretion. No other warranty, expressed or implied accompanies this written warranty.

Section **10** – EPA Information

If you are a dealer and you will be displaying this stove, please cut this tag out and affix it to the stove.

Manufactured by KUMA STOVES INC. Model: ASHWOOD

US ENVIRONMENTAL PROTECTION AGENCY

MEETS EPA PARTICULATE MATTER (SMOKE)
REQUIREMENTS FOR NON-CATALYTIC WOOD HEATERS
MANUFACTURED ON OR AFTER JULY 1, 1990

SAMPLE:

SMOKE
THIS MODEL

TBD

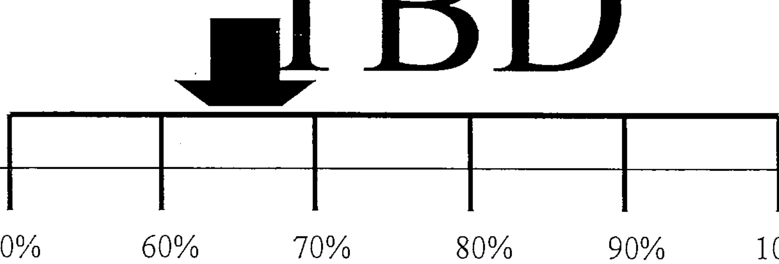
ACTUAL #'S

(GRAMS PER HOUR)

0 7.5

EFFICIENCY*

TBD



Wood heaters with higher efficiencies cost less to operate.
*NOT TESTED FOR EFFICIENCY. THE VALUE INDICATED IS FOR SIMILAR NON-CATALYST EQUIPPED WOOD HEATERS.

HEAT OUTPUT

??,??? TO ??,??? BTU/HR

Use this to choose the right size appliance for your needs. Ask dealer for help.
This wood heater will achieve low smoke output and high efficiency only if properly maintained. See owners manual.

WOODSTOVE DATA SHEET # 30 stove storage4/99

STOVE STORAGE

The Kuma Ashwood Non catalytic Woodstove tested by

Myren Consulting, Inc. is being held in custody by

Kuma Stoves, Inc. and is being stored at:

Kuma Stoves, Inc.
2150 W. Hayden Ave.
Hayden, ID 83835

Contcact person(s): Mark Freeman

Phone: 208 762 8002

A. Temporary storage at Myren Consulting until certification is granted:

A single strap of steel banding is placed around the stove so that the banding crosses the door horizontally, making it impossible to open the door on the unit. If it is necessary to break the banding to check an internal dimension or component, the banding is immediately replaced after the work on the unit is completed. The unit is identified with its name written on a stove storage label that is taped to the window of the unit. (See next page for an example copy of a stove storage label.)

B. Permanent storage after certification has been granted:

The following measures have been taken to permanently seal the unit and prevent tampering. Several lengths of steel banding are placed around the stove in a manner that prevents the door from being opened. At least two of these lengths cross at 90° angles. At each 90° crossing point on the top of the stove and perhaps elsewhere, a Myren Consulting address label is placed over the crossing point. The lab manager then initials the label and it is then taped in place with 2" clear packing tape. The stove is then loaded onto a pallet and strapped to the pallet with several lengths of steel banding. A box - either cardboard, chipboard or plywood - is placed over the stove and attached to the pallet.

C. The sealed unit is identified as follows:

The name of the unit is written on a Myren Consulting address label which is affixed to the outside of the box. The top and sides of the box also have several stove storage labels affixed to it which clearly identify the unit as a test stove being stored pursuant to 40 CFR Part 60. These labels have the name of the stove clearly written on them. (A sample stove storage label follows on the next page.)

D. The unit was returned to the manufacturer via: Commercial Carrier (USF Reddaway) or by pickup truck.

WST5-Form11

WARNING

SEALED EPA TEST STOVE

DO NOT OPEN OR TAMPER WITH THE SEALS AND PACKAGING ON THIS STOVE.

TO DO SO WILL VOID THE CERTIFICATION ON THIS STOVE.

KUMA ASHWOOD

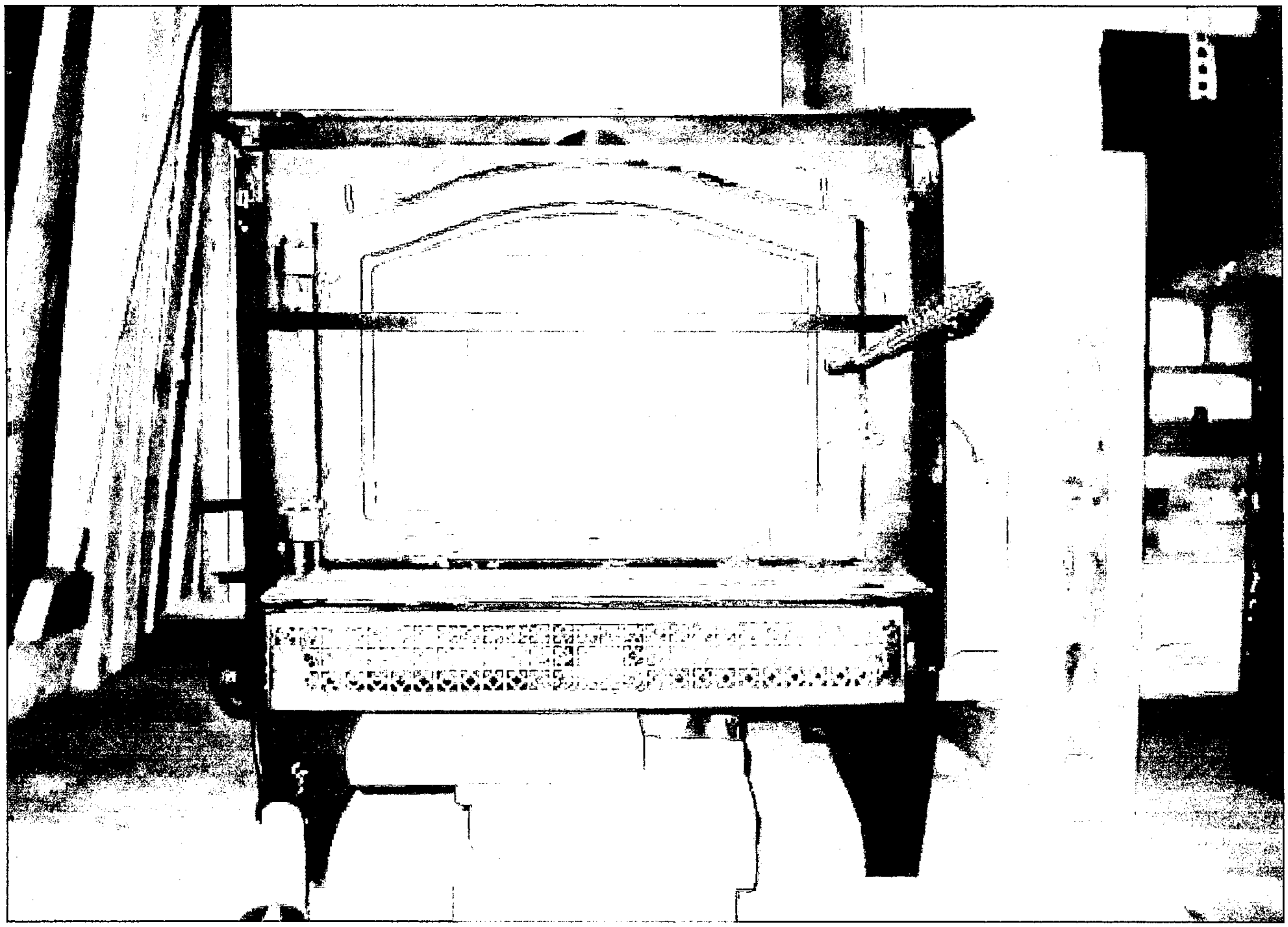
WST5-Form11

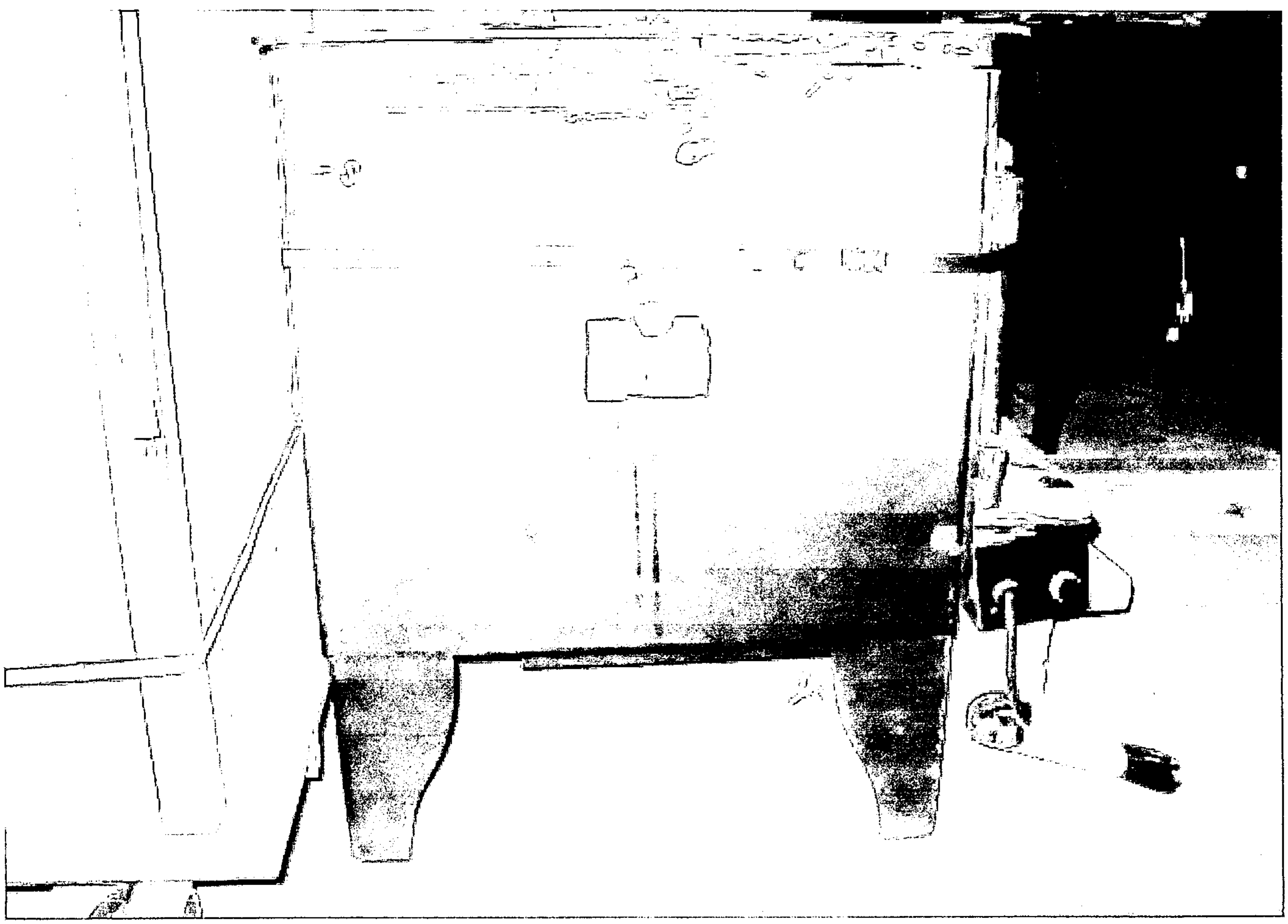
WARNING

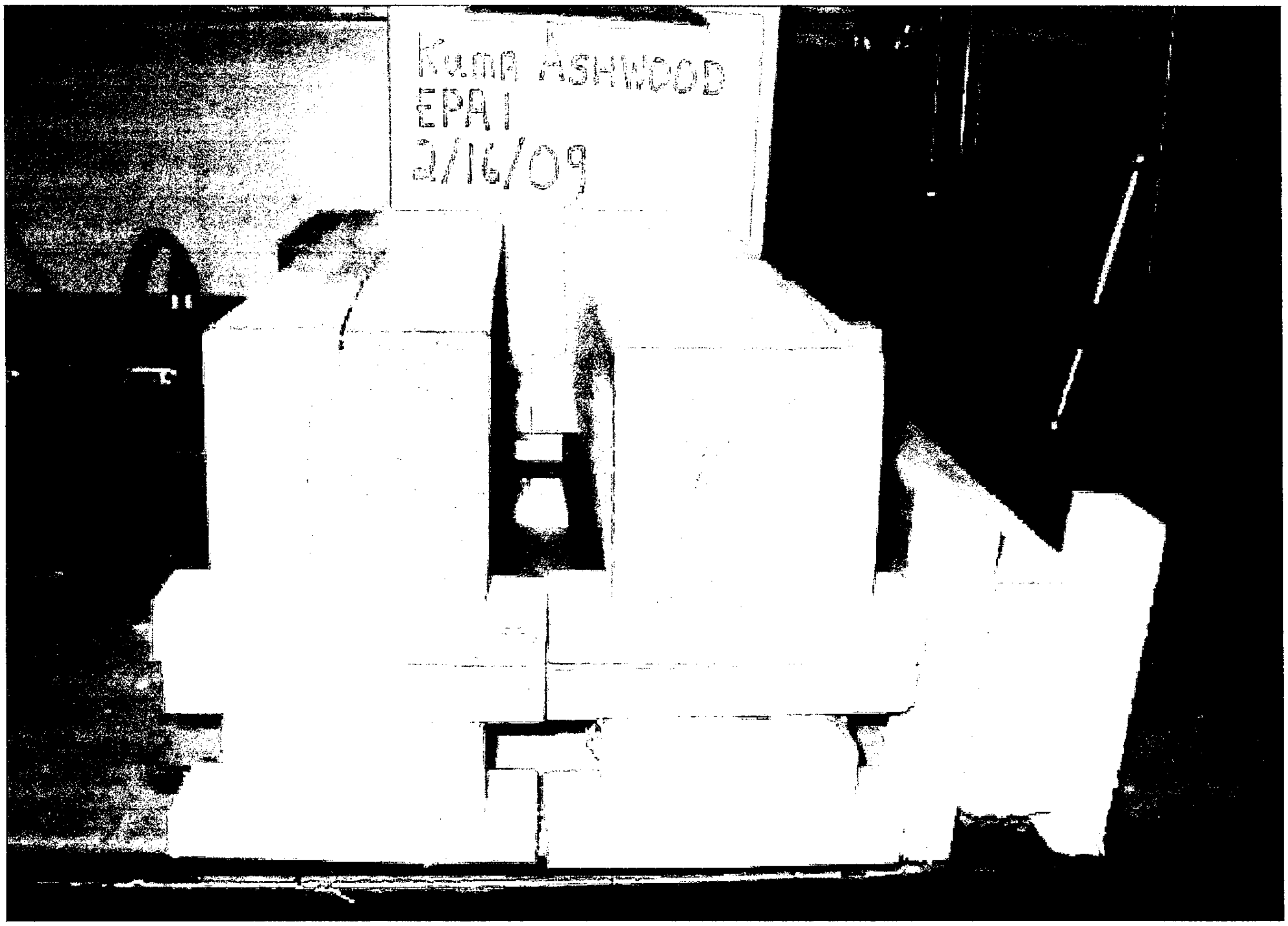
SEALED EPA TEST STOVE

DO NOT OPEN OR TAMPER WITH THE SEALS AND PACKAGING ON THIS STOVE.

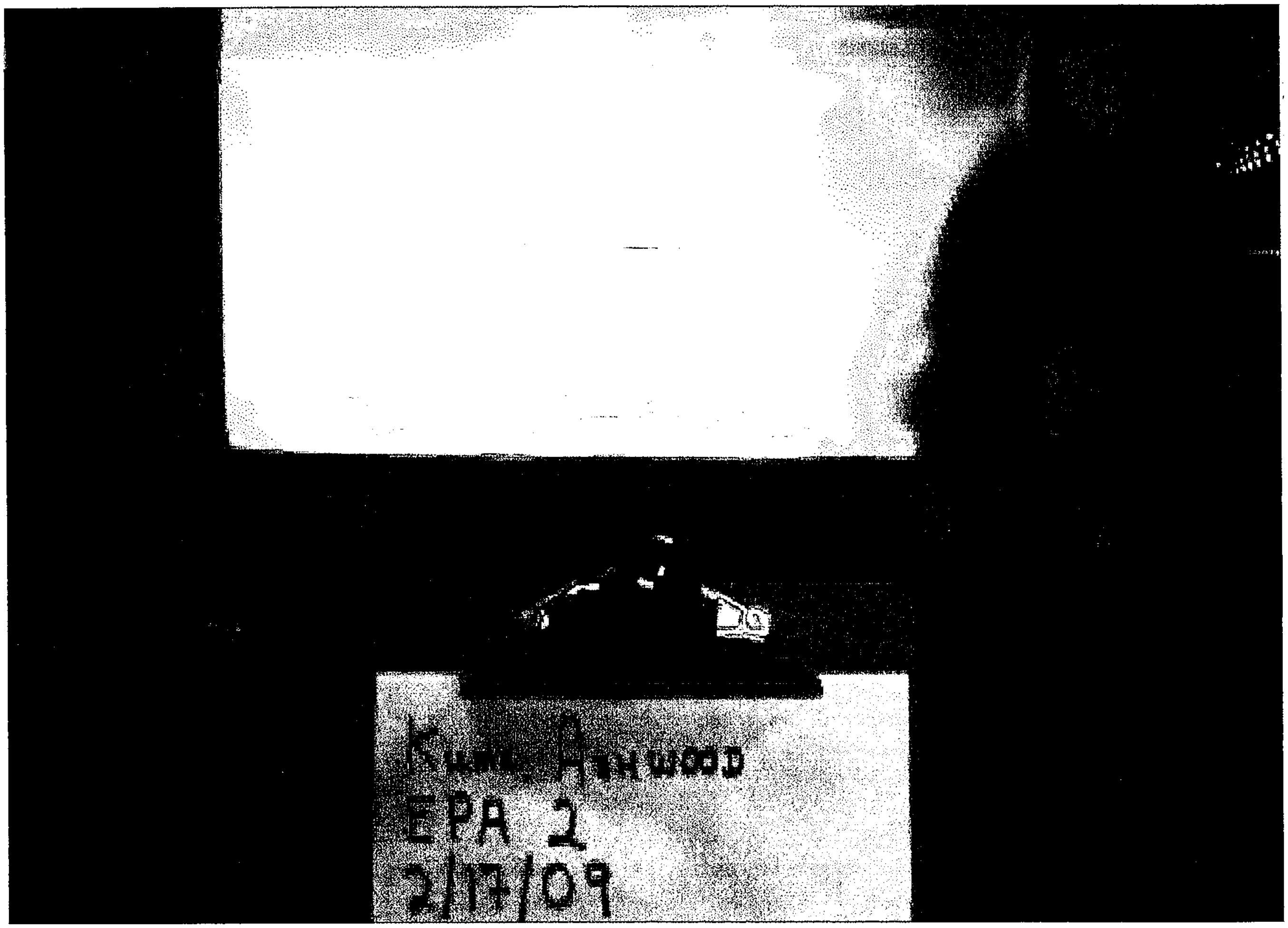
TO DO SO WILL VOID THE CERTIFICATION ON THIS STOVE.

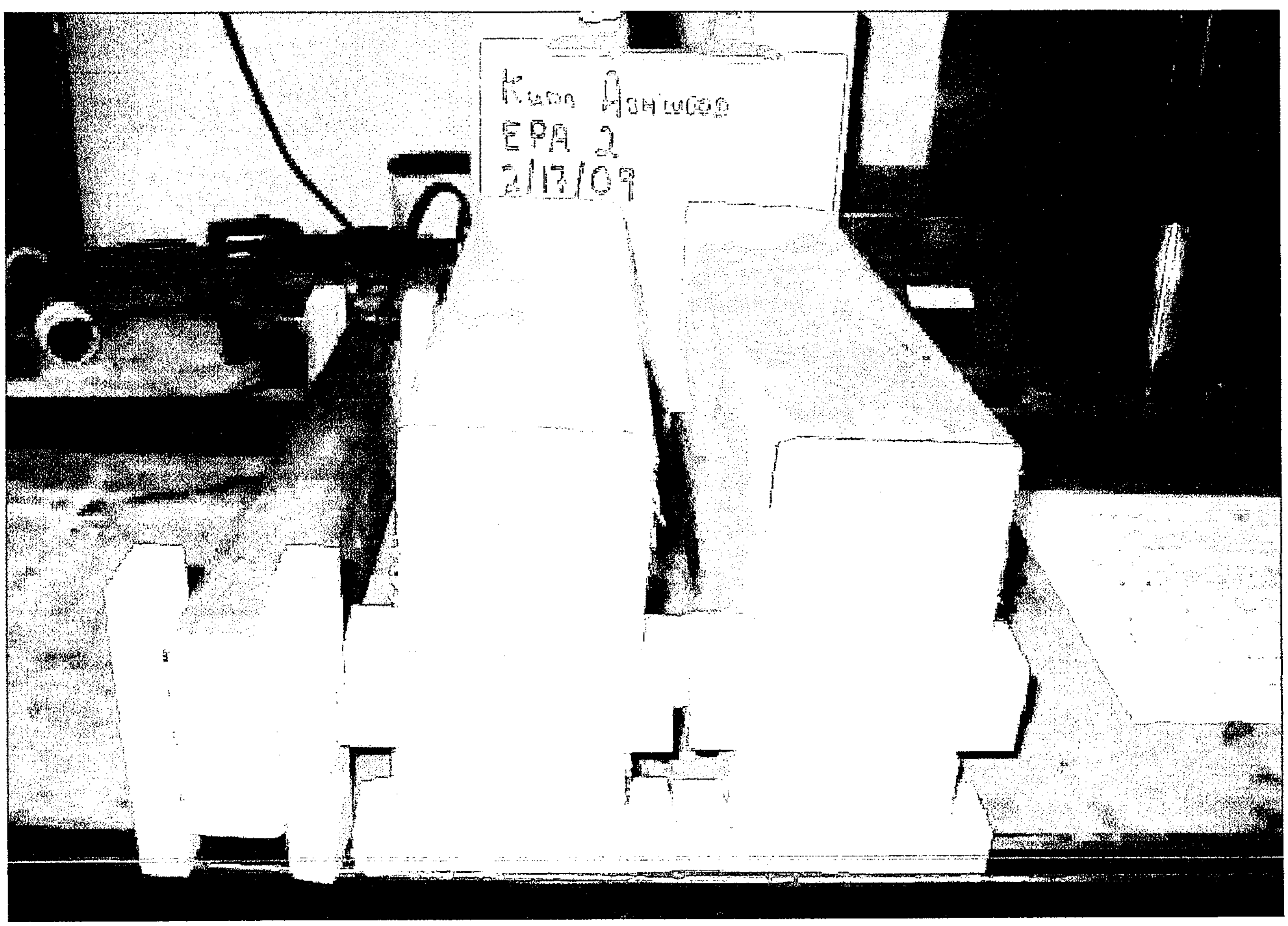


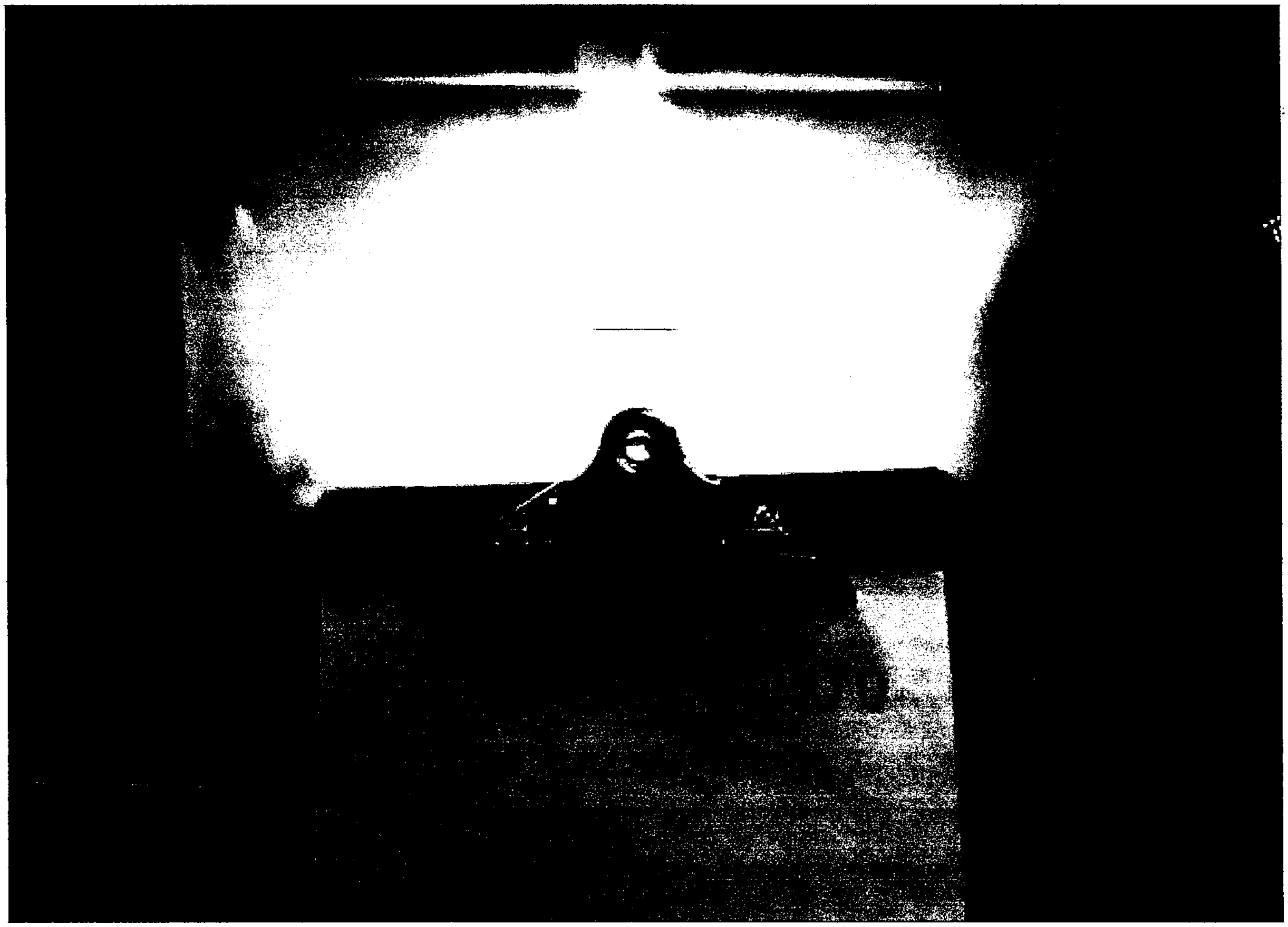


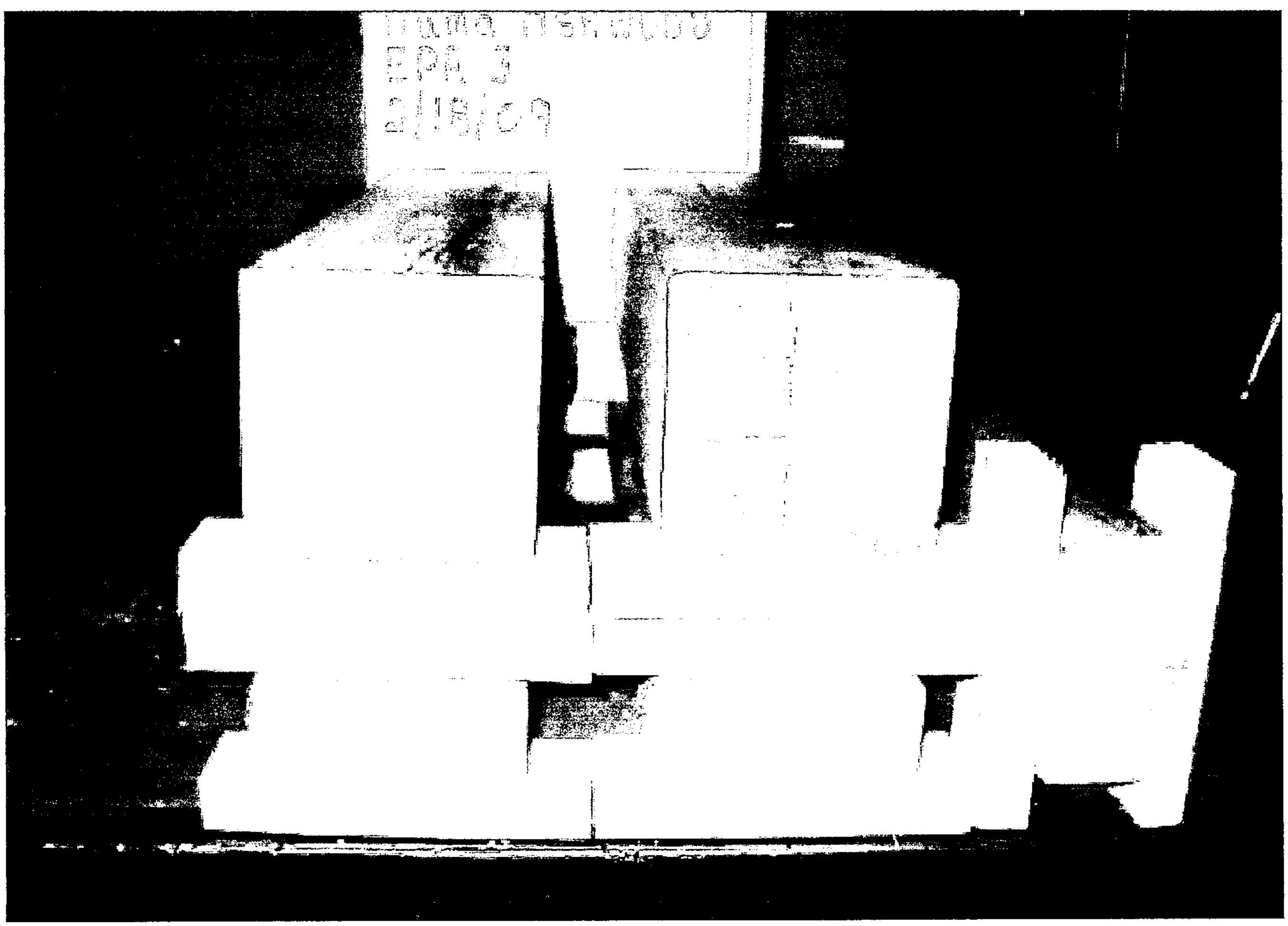

Kuma ASHWOOD
EPA I
2/16/09

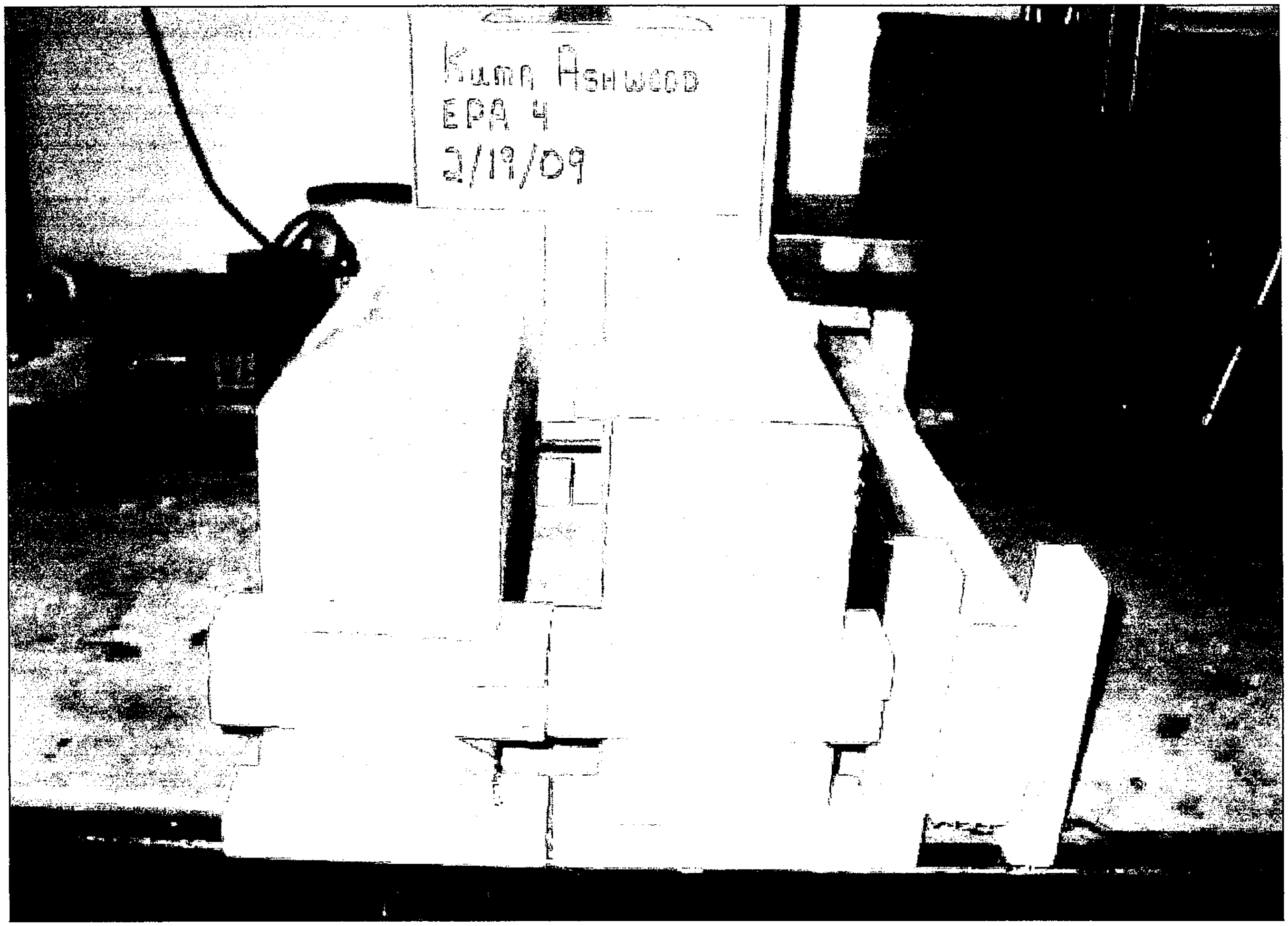

Kuma ASHWOOD
EPA I

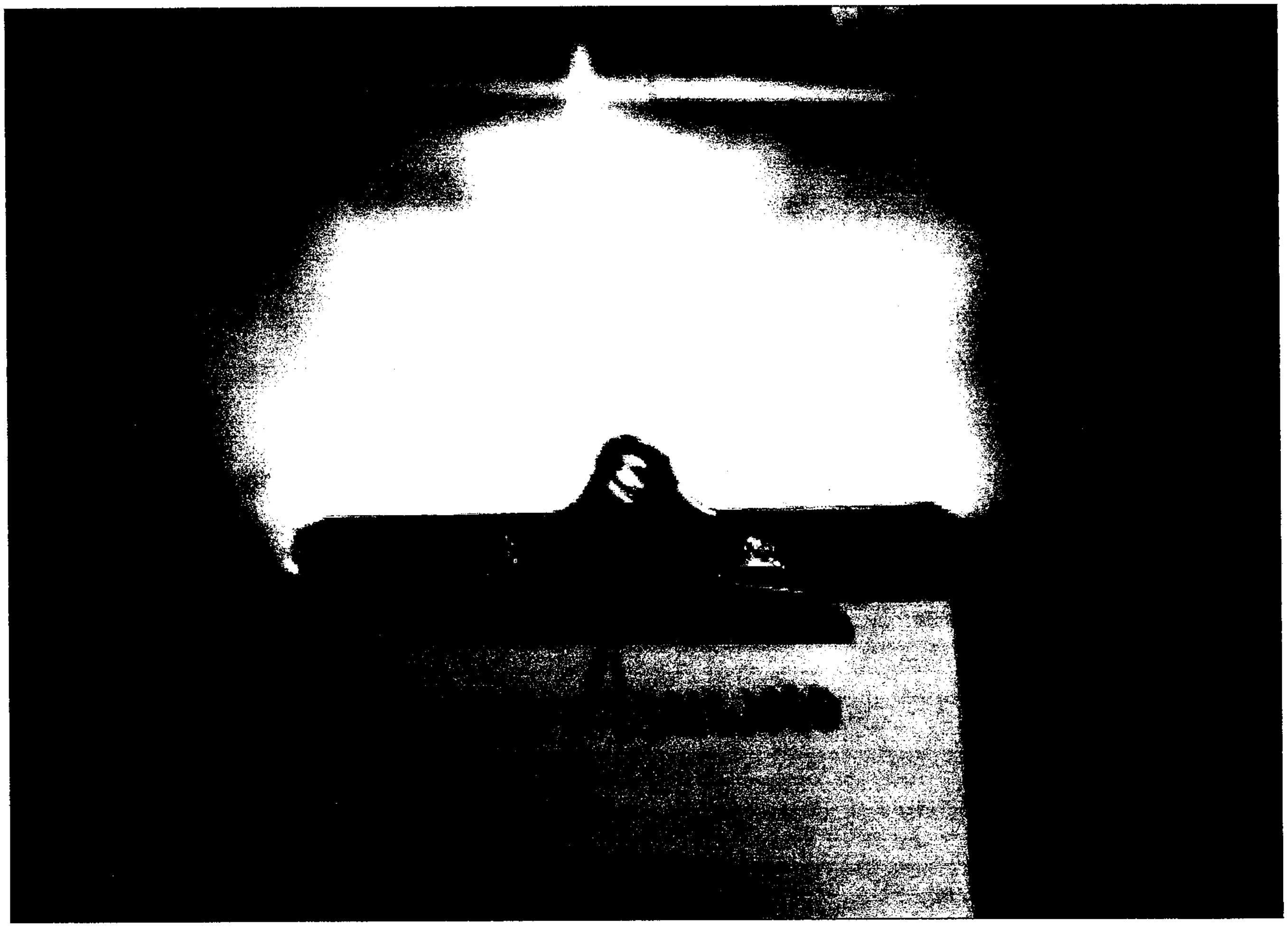

EPA 2
2/17/09


EPA 2
2/17/09

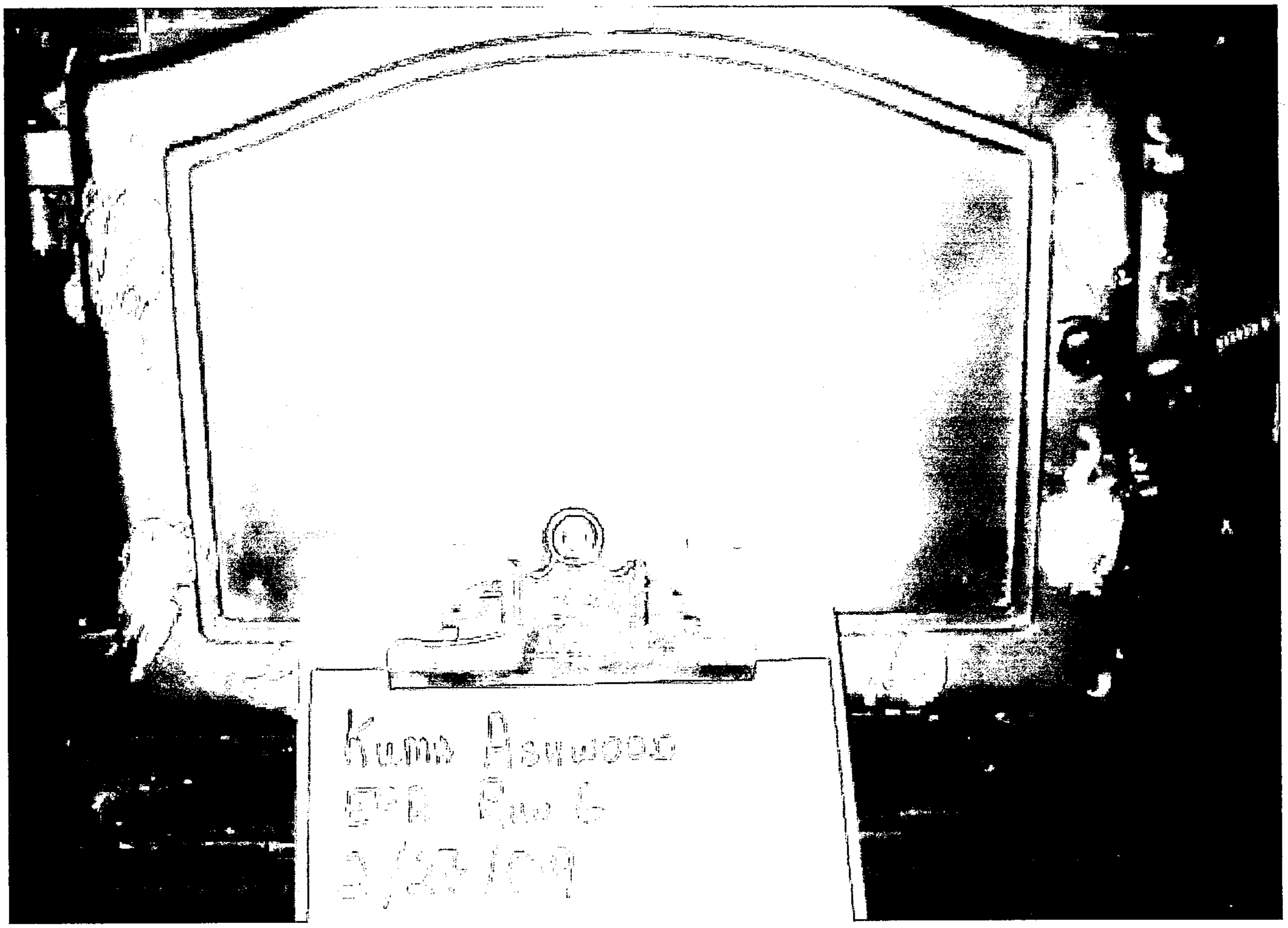


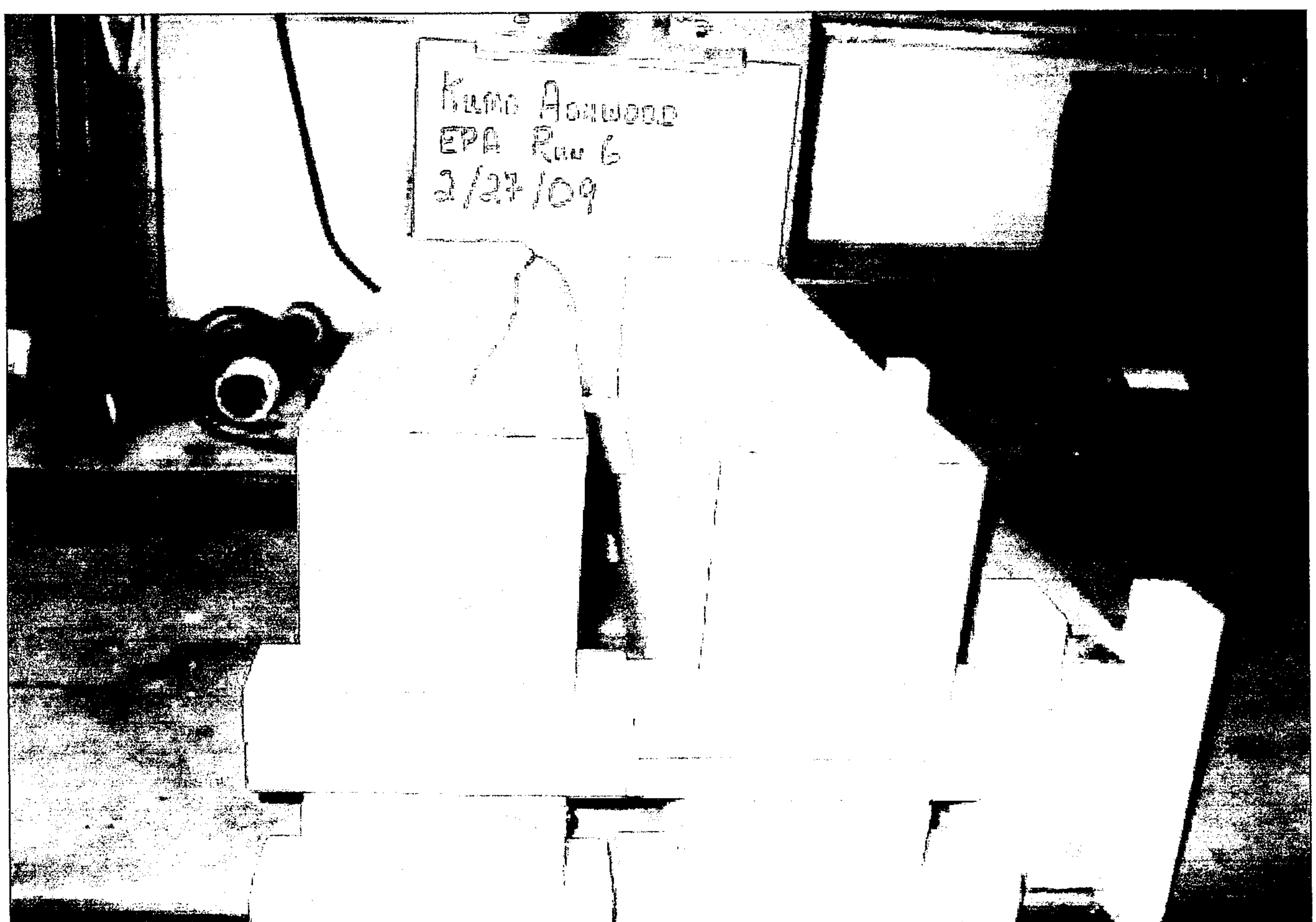

EPA 3
2/18/09


Kuma Ashwood
EPA 4
2/19/09




Kuma Ashwood
EPA 5
2/20/09


Kuma Ashwood
EPA Run 6
2/27/09


Kuma Ashwood
EPA Run 6
2/27/09