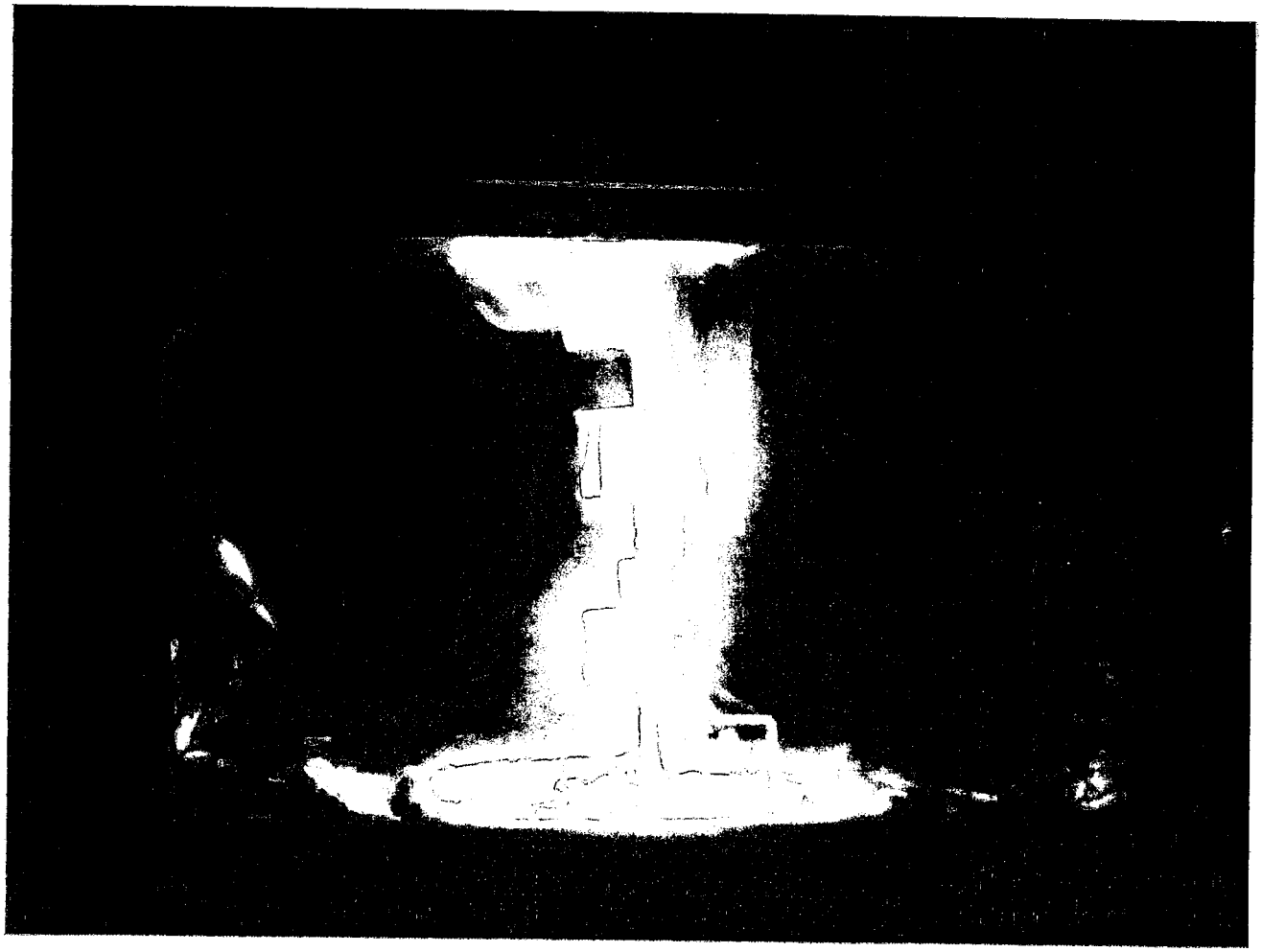
US EPA WOOD HEATER CERTIFICATION TEST REPORT

KUMA STOVES, INC.
KUMA ASPEN
NONCATALYTIC WOOD HEATER

SEPTEMBER 20, 2010



MYREN CONSULTING, INC.

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Confidential

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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.

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Confidential

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Photos:

This sections 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.

Report Certification

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

Date: 9/20/2010 Signature: Albert T. Myren Jr.
Title: President

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

Date: 9/20/2010 Signature: Albert T. Myren Jr.
Title: President

FIELD OBSERVATION CHECKLIST

Unit Name: KUMA ASPEN

Manufacturer Name: KUMA STOVES, INC.

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

Manufacturer Phone: 208 762 8002
Fax: 208 762 5882

Observers & Affiliation: NONE

SUPERVISOR: BEN MYREN

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

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

MYREN CONSULTING, INC.

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TEST SERIES INFORMATION AND DISCUSSION

Unit: Kuma Aspen Noncatalytic Wood Heater

Model: Aspen

Manufacturer: Kuma Stoves, Inc.

Date Received: 7/6/2010 Date(s) Aged: 7/6, 8 & 9/2010

Test Dates: 7/13, 15, 16, 19 and 20, 2010

Sampling Method(s): EPA M5G-1

Fueling Protocol: EPA M28

Number of Test Runs: 5

The Kuma Aspen 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 EPA Certification testing, (3.) a copy of the EPA Laboratory Accreditation Certificate for Myren Consulting's lab in Colville, (4.) letter requesting a waiver from the 30 day certification test notification requirement, (5.) a copy of the M%G-1/M5G-2 dual train comparison testing waiver request sent to EPA and (6.) a discussion of test results.

DISCUSSION:

(1.) 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.

(2.) As noted above this stove was involved in the HPBA/ EPA sponsored M5G-1/ M5G-2 dual train comparison testing that was to help resolve the issue about the correction factor used to convert EPA M5G-1 test results to an EPA M5H equivalent. As per the agreement with EPA, this data is NOT being reported in this report.

Stack Measurements and Sampling Port Locations

Total Stack Height 15.667'
5.0 ± 1 Ft (M28, 4.1.1)

Steel Flue Pipe Ht 107"
8.5 ± .5 ft (M28, 4.1.1)

Wet Bulb/Dry Bulb
Probe Ht N/A
(No Specifications Given)

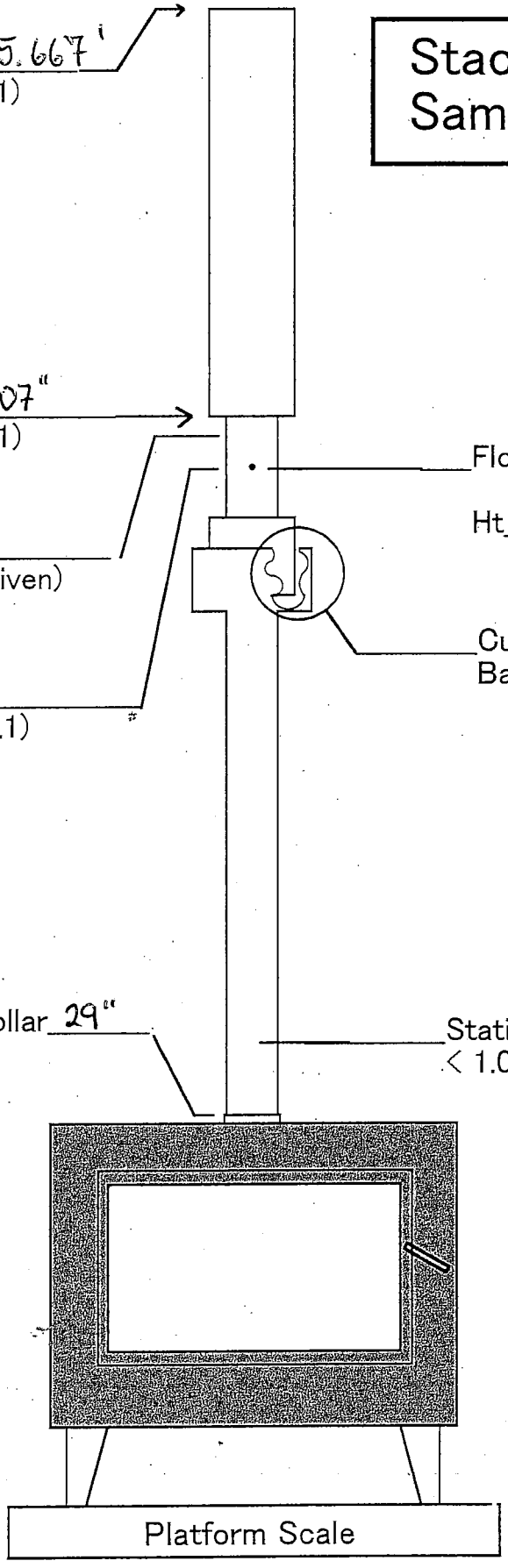
Stack Temperature
Probe Ht 108"
8.5 ± .5 ft (DEQ, 3.3.1)
[ASTM, 9.2.4 (draft)]

Flow Rate Measurement System Probe
Ht 100.75" 7.5 ± 1.0 ft (M5H, 5.1.6)

Cutaway Detail on
Barometric Oil Seal

Stove Ht at Flue Collar 29"

Static Pressure Probe Ht 10.75"
< 1.0 ft Above Flue Connector M28, 6.2.3



Unit Kama V.3

Date 7/12/10

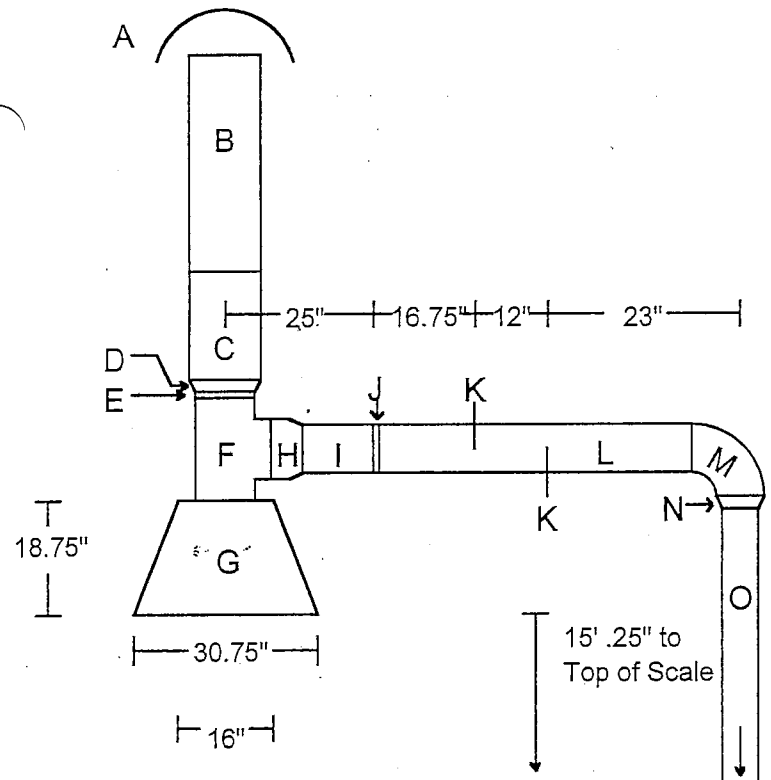
Technician(s) ATM
JZP
PDG
CSD

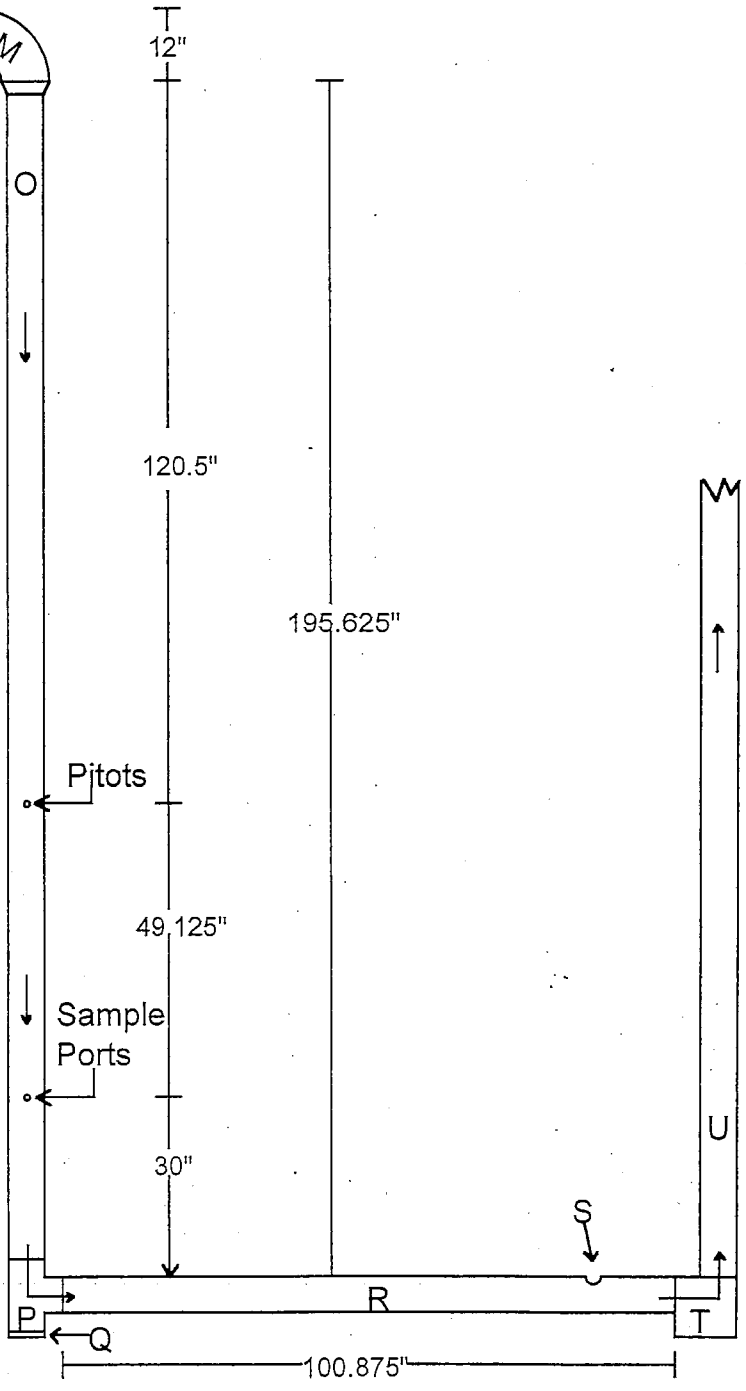
Myren Consulting Inc

Dilution Tunnel Schematic

9/9/1997

Not to Scale
Dimensions Shown are Actual
Total Tunnel Length: 22.635'
(Hood Inlet to Sampling Port)





A: 10" Class A Rain Cap
: 36"- 10" ID Class A Chimney
C: 18"- 10" ID Class A Chimney
D: 10" Class A to Black Pipe Adapter
E: 10" Self Cleaning Full Closure Blast Gate
F: 10"- 22 ga 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: 51.75" of 8" Black Steel Pipe
M: 8" 90 Degree Black Steel Pipe Elbow
N: 8" to 6" Black Steel Pipe Reducer
O: 194.5" of 6" Black Steel Pipe
P: 6" Black Steel Pipe "T" Section
Q: 6" Self Cleaning Full Closure Blast Gate
(for adjusting tunnel flows)
R: 100.875" of 6" Black Steel Pipe
S: 2.25" Diameter Bleed Hole
: Dayton Blower Model# 6K0300
1/3 HP 1725 RPM
U: 6" black Steel Pipe Exhaust

CERTIFICATE OF ACCREDITATION

This certifies that

Myren Consulting, Inc

Has satisfied the requirements for laboratory accreditation for the certification of wood heaters pursuant to subpart AAA of 40 CFR Part 60, New Source Performance Standards For Residential Wood Heaters

June 5, 2007 to June 5, 2012

EFFECTIVE DATE

Connie Sue B. Oldham

Measurement Technology Group
Group Leader

Methods 5G, 28, 28A

METHODS

6

CERTIFICATE NUMBER

Myren Consulting, Inc.

512 Williams Lake Road
Colville, WA 99114
Office: (509) 684-1154
Lab: (509) 685-9458
Fax: (509) 685-2262

Date: 12 July 2010

To: John Dupree

From: Ben Myren

RE: Request for a Thirty Day Certification Test Notification Waiver

Today Myren Consulting, Inc. was contacted by Mr. Mark Freeman of Kuma Stoves, Inc. He asked if we would be able to conduct a certification test series on a unit (the Kuma V.3) that Kuma Stoves has been developing and is now ready to test. Myren Consulting has the time available to conduct the test series, so granting the waiver would be beneficial to all parties. We would like to start the EPA test series on the Kuma V.3 starting on 7/12/2010 or 7/13/2010.

Let me know if the waiver is granted and/or if you have any questions.

Thank You,
Ben Myren

Myren Consulting, Inc.

512 Williams Lake Road

Colville, WA 99114

Office: (509)684-1154 Lab: (509)685-9458

Fax: (509)684-3987 email:atmyren@gmail.com

DATE: 12 July 2010

To: Mr. John Dupree
Wood Heater Program Team Leader
USEPA, Office of Enforcement and Compliance Assurance (OECA)

Re:Request for Waiver for Wood Heater Test Method Comparison Data

This letter will serve as a request that [USEPA, OECA] waive the requirement stated in Applicability Determination #26, dated February 25, 1988 that data from all test methods used during certification testing be reported in the certification test report and used to determine the weighted average emissions for the subject heater. This waiver is for Kuma V.3 Noncatalytic Woodheater and Myren Consulting, Inc.. A waiver of this requirement is needed to allow data from a second emission measurement test method to be gathered concurrently with certification testing for the purposes of generating a test method comparison database. This database is critical for use in determining the relationship between EPA wood heater emission test methods at low emission rates, and will be used in the review of 40 CFR Part 60, Subpart AAA that is currently being conducted by the Office of Air Quality Planning and Standards (OAQPS).

The test method of record for this certification test series will be EPA Method M5G1, The test method for method comparison testing will be EPA Method M5G2.

Data from the test method of record will be included in the certification test report and used for determining the weighted average emissions and compliance with emission limits for the subject heater, pursuant to 40 CFR Part 60, Subpart AAA.

Data from the method comparison testing will not be included in the certification test report or be used for determining compliance with emission limits. The data will be provided to the Hearth, Patio and Barbecue Association (HPBA) and to OAQPS as simple individual test run data pairs without indication of manufacturer or heater model.

EPA WEIGHTED AVERAGES CALCULATIONS
EPA WEIGHTED AVERAGE PARTICULATE EMISSION RATE

The weighted average particulate emission rate ($\overline{PM}$) for the Kuma V.3 Noncatalytic Wood Heater manufactured by Kuma Stoves, Inc. of Hayden, ID is 4.10 g/hr.,

EPA WEIGHTED AVERAGE OVERALL EFFICIENCY

The weighted average overall efficiency ($\overline{OE}$) for the Kuma V.3 is (default) 63 %.

II. EPA TEST RESULTS

* Denotes runs used in weighted average calculations

Run #	Dry Burn Rate/kg/hr	Grams/Hour	Overall Efficiency
2	0.969	3.673	
3	1.238	3.607	
4	1.393	3.402	
1	2.007	7.018	
5*	1.138	3.8914	

* Run 5 = Fan Confirmation Test

III. EPA CUMULATIVE PROBABILITY CALCULATIONS

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

$P_1 = \frac{[\ .380 - .328\ ][\ .969 - 0.950\ ]}{.05} + .328 = .3478$

$P_2 = \frac{[\ .572 - .550\ ][\ 1.238 - 1.200\ ]}{.05} + .550 = .5667$

$P_3 = \frac{[\ .695 - .654\ ][\ 1.393 - 1.350\ ]}{.05} + .654 = .6893$

$P_4 = \frac{[\ .920 - .912\ ][\ 2.007 - 2.000\ ]}{.05} + .912 = .9131$

$P_5 = \frac{[\quad - \quad][\quad - \quad]}{.05} + \quad = \quad$

$P_6 = \frac{[\quad - \quad][\quad - \quad]}{.05} + \quad = \quad$

$P_7 = \frac{[\quad - \quad][\quad - \quad]}{.05} + \quad = \quad$

$P_8 = \frac{[\quad - \quad][\quad - \quad]}{.05} + \quad = \quad$

$P_9 = \frac{[\quad - \quad][\quad - \quad]}{.05} + \quad = \quad$

$P_{10} = \frac{[\quad - \quad][\quad - \quad]}{.05} + \quad = \quad$

$P_{11} = \frac{[\quad - \quad][\quad - \quad]}{.05} + \quad = \quad$

$P_{12} = \frac{[\quad - \quad][\quad - \quad]}{.05} + \quad = \quad$

$P_{13} = \frac{[\quad - \quad][\quad - \quad]}{.05} + \quad = \quad$

$P_{14} = \frac{[\quad - \quad][\quad - \quad]}{.05} + \quad = \quad$

$P_{15} = \frac{[\quad - \quad][\quad - \quad]}{.05} + \quad = \quad$

$K_1 = P_2 - P_0 =$	.5667	.000	.5667
$K_2 = P_3 - P_1 =$	.6893	.3478	.3415
$K_3 = P_4 - P_2 =$	.9131	.5667	.3464
$K_4 = P_5 - P_3 =$	1.0000	.6893	.3107
$K_5 = P_6 - P_4 =$			
$K_6 = P_7 - P_5 =$			
$K_7 = P_8 - P_6 =$			
$K_8 = P_9 - P_7 =$			
$K_9 = P_{10} - P_8 =$			
$K_{10} = P_{11} - P_9 =$			
$K_{11} = P_{12} - P_{10} =$			
$K_{12} = P_{13} - P_{11} =$			
$K_{13} = P_{14} - P_{12} =$			
$K_{14} = P_{15} - P_{13} =$			
$K_{15} = P_{16} - P_{14} =$			

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 ( ) emission rate in grams per hour (g/hr).
K_1, K_2, K_3, ...K_n = The weighting factors for the individual test runs as determined in III above.
PM_1, PM_2, PM_3, ...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, ... K_n = The weighting factors for the individual runs as determined in III above.
OE_1, OE_2, OE_3, ... OE_n = The overall efficiencies for the individual test runs as listed in II above.

IV.A. EPA WEIGHTED AVERAGE PARTICULATE EMISSIONS CALCULATIONS

$\bar{i} = \frac{.5667(3.673)+.3415(3.507)+.3464(3.402)+.3107(7.018)+(\ )+(\ )+(\ )+(\ )+}{.5667+.3415+.3464+.3107+\ +\ +\ +\ +}$

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

$\bar{i} = \frac{2.0815+1.1976+1.1785+2.1805+\ +\ +\ +\ +\ +\ +\ +\ +\ +\ +=}{1.5653\ -}$

$\bar{i} = \frac{6.6381}{1.5653} = 4.2408 = 4.24$ g/hr

IV.B. EPA WEIGHTED AVERAGE OVERALL EFFICIENCY CALCULATIONS

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

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

$\bar{i} = \frac{+\ +\ +\ +\ +\ +\ +\ +\ +\ +\ +\ +\ +\ +=}{\ }$

$\bar{i} = \frac{\ }{\ } = \frac{\ }{\ } = \ \%$

Unit: Kuma V.3

Non Catalyst Cap

Catalyst Cap

KEY: ⊙ = CERTIFICATION TEST

△ = FAN CONFIRMATION TEST

Particulate Emissions (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

(2.007, 7.010)

(0.969, 3.673)

(1.138, 3.891)

(1.393, 3.402)

(1.239, 3.507)

Unit: Kuma 13
Page 1 of 3
WST2-Form12

Woodstove Data Summary

Run #	2	3	4	1		5*		
Particulate Emissions:								
Concentration: grains/dscf:								
grams/m^3:								
Emission Rate: grams/hr:	3,673	3507	3.402	7.018		3,091		
Emission Factor: gms/kg: (dry fuel weight basis)	2.404	1.781	1.526	2.533		2.194		
Front Half Catch: % of total								%
Total Mass Captured: Frt & Bck Halves:	34.29	21.89	18.60	30.88		26.69		mg
Efficiency Valves: (CSA B415 LHV								
Overall Appliance Efficiency		78.95						%
Combustion Efficiency								%
Heat Transfer Efficiency								%
Heat Output: EPA HO$_6$								
Avg. BTU/hr for test cycle	11,689	14,923	16,793	24,206		13,728		BTU/hr
Fuel Burn Rates:								
Avg Kg/hr for test cycle (Wet basis)	1.161	1.485	1.675	2.430		1.371		Kg/hr
Avg Kg/hr for test cycle (Dry basis)	0.969	1.238	1.393	2.007		1.138		Kg/hr

* Run 5 = Fan Confirmation Test

RUN #	2	3	4	1		5			
Fuel Moisture Content:									
Kindling (Wet basis)	8.573	8.792	9.063	8.215		7.063			%
Pretest Fuel (Wet basis)	17.802	17.863	17.173	17.5144		17.469			%
Test Fuel (Wet basis)	16.511	16.648	16.845	17.395		16.949			%
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)	-0.035	-.049	-.053	-.064		-.046			in. H_2O
Proportionality - Average	99.762	99.497	99.596	99.697		99.650			%
Average Stack Gas Emission Factors:									
CO - g/Kg									
g/hr									

RUN #	2	3	4	1		5			
Average Temperatures:									
Stack Gas	255	328	346	457		297			°F
Primary Combustion Chamber Gas	716	938	864	1016		835			°F
Secondary Combustion Chamber Gas	932	1056	1099	1240		1093			°F
Catalytic Combustor Exit Gas	N/A	N/A	N/A	N/A		N/A			°F
Stove Top	525	621	645	755		613			°F
Stove Left Sidewall	487	575	582	658		543			°F
Stove Back	366	448	464	511		453			°F
Stove Right Sidewall	452	531	552	633		522			°F
Stove Bottom	331	415	430	421		488			°F
Stove Temperature Change	-120.0	-111.0	-67.4	-115.0		-114.6			°F
Test Chamber Environment:									
Avg. Barometric Pressure	28.32	28.259	28.3225	28.32		28.305			in Hg
Avg. Temperature	82	84	81	74		82			°F
Avg. % Ambient Moisture	1.65	1.425	1.275	1.10		1.425			% H_2O
Avg. % Relative Humidity	42.5	38.5	38.5	42.5		41			%RH
Avg. Air Velocity	11.0	11	11.5	11.0		10.0			m/sec
Avg. Dilution Tunnel Draft (If Applicable)	.000	.000	.000	.000		.000			in/H_2O
Test Fuel Weight and Burn Time:									
Density (Dry basis)	0.5771	0.5833	0.4323	0.4702		.4939			gm/cm^3
Coal Bed Weight	2.1	2.0	2.3	2.2		2.0			lbs.
Pre Test Fuel Wt (Inc Kindling)	30.168	31.012	29.548	31.274		28.352			lbs.
Test Fuel Load Weight	9.812	9.820	9.846	9.822		9.822			lbs.
Total Test Cycle Burn Time	230	180	160	110		195			min.

Unit Kuma V.3
Date 7/
Technicians ATM JRP PDG
Page 1 of
WST5-Form3, Rev 12/09

Catalytic Combustor Aging Data
OR
Stove Aging Data
Woodstove Test Data Sheet #25

2010 T/C#

Hr. #	Date	Time	Firebox Temp	Secondary Burn Temp	Post Cat	In Cat	Comments
1	7/6	0947	1105	1536			Fire Stoked @ 0744
2	"	1047	780	829			
3	"	1147	786	1394			
4	"	1247	817	900			
5	7/8	1310	1005	1493			Fire Stoked @ 1105
6	"	1410	907	970			
7	"	1510	905	1477			
8	"	1610	910	941			
9	7/9	1345	1089	1488			Fire Stoked @ 11:28
10	"	1445	796	882			
11	"	1545	842	1364			

EPA 2 .10 LOW

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:	V.3
Lab Name:	MYREN
Test Date:	7\15\10
Run Number:	EPA 2
Meter Box Y Factor:	1.0159
Barometric pressure (in):	28.32
Gas meter temp (ave):	**94**
delta H(avg):	**0.900**
Gas meter initial reading:	678.2000
Gas meter final reading:	800.0950
Front catch (acetone) mg:	0.00499
first filter catch (mg):	25.7
second filter catch (mg):	4.99
Tunnel Flow (Qsd) (dscfm)	**141.607**
Emission Rate(g/hr):	**2.330**
Emission Rate(M5H) :	**3.673**
Avg. of Delta P Sq. Roots:	**0.1990**
Vs (Avg.)(ft/min):	**839.292**
Tunnel Avg. Temperature (F):	**97.958**
Test time(min):	230
Fuel Load(lb. wet):	9.812
Wood moisture(%wet):	16.511
Burn rate(dry kg/hr):	**0.969**
Sample Volume (dscf)	**111.910**
Avg. Tunnel Static (-inch H2O):	**0.1618**
Room Blank Catch (mg/dscf):	0
Emission Factor (g/kg):	**2.4041**
Pitot Correction Factor:	0.97133
front filter number	115
back filter number	114
Beaker Number:	27
PRELIMINARY RESULTS	
FINAL RESULTS:	AUDITED

DATA SUMMARY

MODEL:	V.3
RUN:	EPA 2
DATE:	7\15\10
DBR:	0.969
EMISSION RATE (g/hr)(M5H)	3.6732
EMISSION FACTOR (g/kg):	2.4041
AVG. % PROPORTIONALITY :	99.762

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	96	678.2000	74	0.900	842.24			0.164	0.2000	
10	0.039	107	683.4400	78	0.900	839.83	106.5	4.955	0.164	0.1975	
20	0.039	101	688.6890	82	0.900	835.37	104.6	4.926	0.160	0.1975	
30	0.039	105	693.9380	86	0.900	838.35	103.4	4.890	0.162	0.1975	
40	0.038	104	699.1830	89	0.900	826.80	103.4	4.860	0.164	0.1949	
50	0.039	103	704.4490	92	0.900	836.86	101.3	4.853	0.162	0.1975	
60	0.040	103	709.7370	94	0.900	847.53	99.7	4.856	0.164	0.2000	
70	0.040	100	715.0090	95	0.900	845.26	98.8	4.832	0.163	0.2000	
80	0.039	99	720.3140	96	0.900	833.88	100.2	4.854	0.163	0.1975	
90	0.040	100	725.6230	97	0.900	845.26	98.8	4.849	0.161	0.2000	
100	0.040	99	730.9250	97	0.900	844.50	98.6	4.842	0.160	0.2000	
110	0.040	98	736.2400	97	0.900	843.75	98.7	4.854	0.165	0.2000	
120	0.040	97	741.5610	98	0.900	842.99	98.6	4.860	0.162	0.2000	
130	0.040	96	746.8750	98	0.900	842.24	98.2	4.844	0.160	0.2000	
140	0.040	96	752.2060	98	0.900	842.24	98.5	4.860	0.164	0.2000	
150	0.039	95	757.5260	98	0.900	830.89	99.4	4.850	0.160	0.1975	
160	0.039	95	762.8450	98	0.900	830.89	99.4	4.849	0.158	0.1975	
170	0.040	95	768.1700	99	0.900	841.48	97.9	4.846	0.163	0.2000	
180	0.040	94	773.4930	98	0.900	840.72	98.2	4.853	0.160	0.2000	
190	0.040	94	778.8170	98	0.900	840.72	98.2	4.854	0.160	0.2000	
200	0.040	94	784.1390	99	0.900	840.72	97.8	4.843	0.160	0.2000	
210	0.039	94	789.4600	99	0.900	830.15	99.0	4.842	0.161	0.1975	
220	0.040	93	794.7780	99	0.900	839.96	97.6	4.839	0.162	0.2000	
230	0.040	93	800.0950	99	0.900	839.96	97.6	4.839	0.161	0.2000	
240											
250											
260											
270											
280											
290											
300											
310											
320											
330											
340											
350											
360											
370											
380											

MYREN CONSULTING, INC.
6 Inch Dilution Tunnel Traverse Data

Unit: Kuma V.3
Run #: CPA2
Date: 7/15/10
Technicians: ATM JRP PDG
Rev 2/22/09

Point	Location	Δp	$\sqrt{\Delta p_{trav}}$	$\sqrt{\Delta p_{cent}}$	T_{trav} (12)	T_{cent} (12)	Pg
W-1	0.5"	.034	.1844		97		
2	1.5	.042	.2049		99		
Center	Center	.041		.2025		100	-.163
3	4.5	.040	.2000		102		
4	5.5	.037	.1975		97		
S-1	0.5	.036	.1897		97		
2	1.5	.040	.2000		97		
Center	Center	.041		.2025		97	-.165
3	4.5	.040	.2000		97		
4	5.5	.039	.1975		97		
	Totals		1.5740	.4050	783	197	-.328
	Average		.1968	.2025	97.98	98.5	-.164
	°R = (°F + 460)				557.9	558.5	

BP: 28.34 in. Hg Ps = BP+(Pg/13.6) = 28.34 + (-.164 /13.6) = 28.328 in. Hg

LEAK CHECKS:
Pre Test: Pg Leg: OK JRP Velocity Head Leg: OK JRP
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 V.3 DATE: 7/15/10 RUN #: EPA 2 TECHNICIAN(S): _____

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

(9) $V_{strav} = (85.49)(0.99\ cp)(.1968\ \overline{x}\ \sqrt{\Delta P}\ "H_2O)\sqrt{\frac{557.9\ T_s\ °A}{(28.328\ P_s\ "Hg)(28.56\ lb./\ lb.\ mole)}}$ = 13.83142 fps

{2} {2} {0} {2} 809.048 {2} 5

(9A) Vs = (13.83142 fps)(60) = 829.8885 fpm

{2} {2} 3

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

(9) $V_{scent} = (85.49)(0.99\ cp)(.2075\ \overline{x}\ \sqrt{\Delta P}\ "H_2O)\sqrt{\frac{558.5\ T_s\ °A}{(28.328\ P_s\ "Hg)(28.56\ lb./\ lb.\ mole)}}$ = 14.23967 fps

{2} {2} {0} {2} 809.048 {2} 5

(9A) Vs = (14.23967 fps)(60) = 854.3802 fpm

{2} {2} 3

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

Fp = Vstrav/ Vscent = 13.83142 ÷ 14.23967 = .971330 5

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

(10) $Q_{sd} = 3600(1 - 0.04\ B_{ws})(13.83142\ fps)(.1963\ ft^2)[(528\ °A)(28.328\ P_s\ "Hg)/(557.9\ T_s\ °A)(29.92"\ Hg)$ =

{2} {3} {2} {0}

8407.99971 dscfhr (or dscfh)

{1}

(10A) 8407.99971 dscfhr ÷ 60 = 140.13333 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.

M5G-1

Unit: Kuma V.2
Run: 5 of 5
Date: 7/15/10
Page 1 of 2 Rev 5/10

Method 5G Particulate Sampling Data

Meter Box 45G-P Meter Y 1.0159 Filter #'s: (F) 115 (R) 114

Filter/O-Ring ID #: —

.957/.9575
Pre Test Leak Check: .0005 CFM@ -15.3 in Hg Filter Size: 110 mm

.153/.154
Post Test Leak Check: .001 CFM@ -15.4 in Hg

Probe ID #: —

Probe Length 21.5 in

Time		Meter Reading (ft³)	Pitot		Tunnel Temp (°F)	Meter Temp (°F)	Gas Meter Δh	Vac (in Hg)
Clock	Elapsed		ΔP	Pg				
1338	00	678.200	.040	-.164	96	74	0.90	0
48	10	683.440	.039	-.164	107	78	.90	0
58	20	688-689	.039	-.160	101	82	.90	0
1408	30	693.938	.039	-.162	105	86	.90	0
18	40	699.183	.038	-.164	104	89	.90	0
28	50	704.449	.039	-.162	103	92	.90	0
38	60	709.737	.040	-.164	103	94	.90	0
48	70	715.009	.040	-.163	100	95	.90	0
58	80	720.314	.039	-.163	99	96	.90	0
1508	90	725.623	.040	-.161	100	97	.90	0
18	100	730.925	.040	-.160	99	97	.90	0
28	10	736.240	.040	-.165	98	97	.90	0
38	120	741.561	.040	-.162	97	96	.90	0
48	30	746.875	.040	-.160	96	98	.90	0
58	40	752.206	.040	-.164	96	96	.90	0
1608	50	757.526	.039	-.160	95	98	.90	0
18	60	762.845	.039	-.158	95	98	.90	0
28	70	768.170	.040	-.163	95	99	.90	0
38	180	773.493	.040	-.160	94	96	.90	0
48	90	778.817	.040	-.160	94	98	.90	0

	BP		
00	28.34		
60	28.33		
120	28.32		
180	28.31		
230	26.30	Avg. =	28.32

Pre Test Filter Check Weighing
F .6539
R .6547

End of Test Weight
F .6793 R .6585
.6806 .6597
.6536 .6550
270 4.7
25.7

M5G-1

Unit: Kuma V.2
Run: TPA 2
Date: 7/19/10
Page 1 of 2 Rev 5/10

Method 5G Particulate Sampling Data

Meter Box 45G-P Meter Y 1.0159 Filter #'s: (F) 115 (R) 114

.9571.9575 Filter/O-Ring ID #: —

Pre Test Leak Check: .0005 CFM@ -15.3 in Hg Filter Size: 110 mm

.153/.154 Probe ID #: —

Post Test Leak Check: .001 CFM@ -15.4 in Hg Probe Length 21.5 in

Time		Meter Reading (ft³)	Pitot		Tunnel Temp (°F)	Meter Temp (°F)	Gas Meter Δh	Vac (in Hg)
Clock	Elapsed		ΔP	Pg				
1658	200	784.139	.040	-.160	94	99	0.90	0
1708	10	789.460	.039	-.161	94	99	.90	0
18	20	794.778	.040	-.162	93	99	.90	0
28	30	800.095	.040	-.161	93	99	.90	0
	240							
	50							
	60							
	70							
	80							
	90							
	00							
	10							
	20							
	30							
	40							
	50							
	60							
	70							
	80							
	90							

BP

00	26.34		
60	26.33		
120	26.32		
180	26.31		
230	26.30	Avg. =	

Pre Test Filter Check Weighing
F .6539
R .6547

End of Test Weight
F _____ R _____

.6536 .6550

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

Into Dessicator: Date 11/20/09 Time 1026 By PDQ Front Half ✓ Back Half ✓

Manufacturer: PALL P/N 60115 Size: 110 mm Lot.No.: T72680 Grade: A/E GLASS

Filter #	First Wt	2010 Date	Time	By	Second Wt	2010 Date	Time	By	Third Wt	Date	Time	By
101	.6559	1/21	1103	PDQ	.6559	7/6	1802	ATM				
102	.6532		1104	PDQ	.6533		1800	ATM				
103	.6552		1105	PDQ	.6551		1801	ATM				
104	.6545		1106	PDQ	.6545		1800	ATM				
105	.6556		1107	PDQ	.6555		1759	ATM				
106	.6545		1108	PDQ	.6546		1758	ATM				
107	.6546		1109	PDQ	.6547		1757	ATM				
108	.6522		1110	PDQ	.6524		1756	ATM				
109	.6558		1111	PDQ	.6557		1755	ATM				
110	.6531		1112	PDQ	.6530		1754	ATM				
111	.6511		1113	PDQ	.6510		1753	ATM				
112	.6538		1114	PDQ	.6537		1752	ATM				
113	.6553		1115	PDQ	.6553		1751	ATM				
114	.6548		1115	PDQ	.6550		1750	ATM				
115	.6533		1116	PDQ	.6536		1749	ATM				
116	.6580		1117	PDQ	.6579		1748	ATM				
117	.6543		1118	PDQ	.6545		1747	ATM				
118	.6564		1119	PDQ	.6564		1747	ATM				
119	.6564		1120	PDQ	.6562		1746	ATM				
120	.6548		1121	PDQ	.6549		1745	ATM				
121	.6526		1122	PDQ	.6527		1744	ATM				
122	.6565		1123	PDQ	.6564		1743	ATM				
123	.6567		1124	PDQ	.6568		1743	ATM				
124	.6550		1125	PDQ	.6552		1742	ATM				
125	.6528	—	1126	PDQ	.6529	✓	1741	ATM				

Checked by ATM MW Date: 7/6/10 Time 1805

QA REWEIGH

Filter #	WT	Date	Time	By
106	.6545	7/7/10	0657	dm
115	.6533	7/7/10	0658	dm
121	.6525	7/7/10	0659	dm

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	2010 Date	Time	By
56	72	34	1/21	0952	PDQ
58	70	40	7/6/2010	1630	ATM
58	70	48	7/7/10	0645	ATM

Post	1/21	7/6	7/16
0.0000	0.0000	0.0000	
100.0000	99.9992	99.9990	

Woodstove Data Sheet #4-2: Initial Beaker Weights (Tare Weights)

Scale 2

Into Dessicator: Date 4 May 10 Time 0940 By ATM

Balance Used: Sartorius Model: CP224S SN: [redacted]

Beaker #	First Wt	Date	Time	By	Second Wt	2010 Date	Time	By	Third Wt	Date	Time	By
20	3171	5/5	1453	ATM	73.3176	5/7	1641					
21	.0018		1504	ATM	71.0022	5/7	1704		71.0018	5/8/10	1245	ATM
22	.8331		1503	ATM	71.8344	5/7	1705		71.8337	5/8/10	1246	ATM
23	.7386		1455	ATM	70.7392	5/7	1708		70.7295	5/8/10	1227	ATM
24	.2178		1456	ATM	73.2187	5/7	1700		73.2187	5/8/10	1229	ATM
25	.6518		1459	ATM	72.6516	5/7	1650		72.6511	5/11/10	1447	ATM
26	.7872		1507	ATM	71.7879	5/7	1647		71.7875	5/11/10	1438	ATM
27	.3304		1508	ATM	72.3311	5/7	1657		72.3305	5/10/10	1243	ATM
29	.5185		1510	ATM	71.5198	5/7	1656		71.5193	5/11/10	1443	ATM
30	.8552		1511	ATM	70.7856	5/7	1658		70.7855	5/11/10	1641	ATM
32	.5986		1506	ATM	53.5999	5/7	1702		53.5996	5/10/10	1235	ATM
33	.1475		1505	ATM	53.1488	5/7	1701		53.1484	5/11/10	1437	ATM
36	.5736		1501	ATM	53.5747	5/7	1707		53.5742	5/8/10	1238	ATM
38	.2513		1500	ATM	53.2523	5/7	1703		53.2520	5/8/10	1239	ATM
40	.4617		1457	ATM	53.4625	5/7	1706		53.4624	5/8/10	1236	ATM
41	.8355		1458	ATM	52.8364	5/7	1707		52.8358	5/8/10	1289	ATM
43	.2319	↓	1440	ATM	53.2323	5/7	1640					
31	.6666	5/7/10	1655		69.6666	5/11	1445	ATM				
37	53.7163	5/7/10	1646		53.7159	5/11	1440	ATM				
(cont.)												
22	71.8338	5/11/10	1623									
27	72.3287	5/11/10	1622		72.3305	5/12/10	1500	ATM	72.3304	6/2/10	1620	

BLK

Checked by ATM Date: 6/2/10 Time: 1610

QA Reweigh

Beaker #	WT	Date	Time	By
22	71.8339	6/2/10	1617	ATM
32	53.5997	6/2/10	1619	
21	71.0021	6/2/10	1620	

Balance Room Environmental Conditions

WB 61	DB 73	%RH 44	Date 5/5	Time 1126	By ATM
59	73	42	5/7/10	1600	ATM
59	71	48	5/8/10	1140	ATM
55	69	42	5/11/10	1349	ATM
60	73	46	5/12/10	1314	ATM
61	75	45	6/2/10	1602	ATM

		1st	2nd	3rd	4th	5th	6th
Post Weighing	Date 0.0000g	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Scale Check	100.0000g	99.9996	99.9995	99.9995	99.9995	99.9995	99.9995

M5G-1

Unit Kuma V.3

Woodstove Data Sheet #4-3: Constant Final Weights

Run # EPA2

Date: 7/15/10

60 ml

WST5-Form 9, Pg 1, Rev 5/10

Final Beaker Weights

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
27	72.3339	7/17	1911	ATM	72.3374	7/18	2040		72.3359	7/19	1113	ATM	72.3351	7/20	2135	
					72.3371	7/21	1812	ATM	72.3361	7/22	1643	ATM	72.3369	7/23	2158	
					72.3357	7/27	2042	ATM	72.3359	7/28	1430		72.3356	7/29	1353	ATM

Final Filter Weights

	Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
F	115	.6806	7/15	1858	ATM	.6794	7/16	1835		.6793	7/17	1853	ATM				
R	114	.6597	7/15	1855	ATM	.6584	7/16	1830		.6585	7/17	1851	ATM				

QA Reweigh: Final Weight

Date	Beaker #	Final Wt	By

Date	Filter #	Final Wt	By

Scale Room Environmental Conditions

Weighing Session	Date	Time	By	WB	DB	%RH
1	7/16	1810	ATM	61	75	44
2	7/17	1800	ATM	60	73	46
3	7/18	2015	ATM	61	74	47
4	7/19	1040	ATM	60	73	46
5	7/20	1350	ATM	59	72	45
6	7/21	1715	ATM	63	77	45

Scale Room Environmental Conditions

7	7/22	1617	ATM	61	74	46
8	7/26	3141	ATM	62	76	45
9	7/27	2206	ATM	63	76	49
10	7/28	1340	ATM	64	77	49
11						

Comments

Acetone Blank 7/13/10
Bkr 29 50 ml Acetone
Lot # 074092 Tare Wt. 71.5193

Woodstove Data Sheet #4-3: Constant Final Weights

Kuma

Unit Kuma V.3
Run # EPA 2
Date: 7/15/10

WSTS-Form 9, Pg 1, Rev 5/10

Final Beaker Weights

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
29	71.5194	7/30	1546	AM	71.5180	7/31	1111	ATM	71.5195	7/31	1028	JC	71.5194	8/1	0941	AM

Final Filter Weights

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

QA Reweigh: Final Weight

Date	Beaker #	Final Wt	By

Date	Filter #	Final Wt	By

Scale Room Environmental Conditions

Weighing Session	40 to Date	Time	By	WB	DB	%RH
1	7/31	1020	ATM	58	72	42
2	7/31	2005	ATM	64	77	49
3	8/1	0926	AM	64	77	49
4						
5						
6						

Scale Room Environmental Conditions

7					
8					
9					
10					
11					

Comments

Woodstove Data Sheet 4-4 Scale QC Record Sheet

Scale 1

From: 7/20/10

Through:

Scale: Sartorius
Model: CP224S
SN: 17050374
Rev: 3/10

* 135.0000 g = 100.0000 + 20.0000 + 10.0000 + 5.0000 wts, 100g wt = 99.9991 - 90

Level	Recalibrated	130g * Weights	100g Weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	2010 Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9988	99.9989	9.9999	1.0000	0.1000	0.0199	7/20	1350	ATM	28.36	59	72	45	118
Yes	Yes	134.9988	99.9989	9.9999	0.9999	0.0999	0.0199	7/21	1715	ATM	28.22	63	77	45	117
Yes	No	134.9988	99.9989	10.0000	1.0000	0.1000	0.0199	7/22	1617	ATM	28.16	61	74	46	119
Yes	Yes	134.9989	99.9990	9.9999	1.0000	0.0999	0.0199	7/26	2141	ATM	28.15	62	76	45	120
Yes	No	134.9990	99.9991	9.9999	1.0000	0.0999	0.0199	7/27	2206	ATM	28.32	63	76	49	119
Yes	No	134.9991	99.9992	9.9999	1.0000	0.1000	0.0199	7/28	1340	ATM	28.34	64	77	49	116
Yes	No	134.9989	99.9990	9.9999	1.0001	0.1001	0.0200	7/29	1330	ATM	28.41	64	77	49	115
Yes	No	134.9990	99.9991	9.9999	1.0000	0.1000	0.0199	7/30	1639	ATM	28.25	64	77	49	116
Yes	No	134.9989	99.9989	9.9999	0.9999	0.0999	0.0199	7/31	1020	ATM	28.29	58	72	42	116
Yes	No	134.9990	99.9991	9.9999	1.0000	0.1000	0.0199	7/31	2005	ATM	28.22	64	77	49	119
Yes	Yes	134.9988	99.9989	9.9999	0.9999	0.1000	0.0199	8/1	0926	ATM	28.32	56	68	46	116
Yes	No	134.9988	99.9989	9.9999	1.0001	0.0999	0.0199	8/1	2050	ATM	28.30	61	74	47	117
Yes	Yes	134.9988	99.9989	9.9999	1.0001	0.1000	0.0199	8/2	0756	ATM	28.40	58	70	48	117
Yes	Yes	134.9988	99.9989	9.9999	1.0000	0.1001	0.0199	8/3	1600	JRP	28.34	58	70	48	116

Woodstove Data Sheet 4-4 Scale QC Record Sheet All Scales and Desiccators Individually Grounded Now.
Scale 1

From: 5/31/10
Through: 7/19/10

Scale: Sartorius
Model: CP224S
SN: 17050374
Rev: 3/10

* 135.0000g = 100.0000 + 20.0000 + 10.0000 + 5.0000 wts. 100g WT = 99.9991-99.9990

Level	Recalibrated	130g* Weights	100g Weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9992	99.9992	9.9999	1.0001	0.1001	0.0200	5/31/10	10:45	ATM	28.21	58	70	48	120
Yes	No	134.9992	99.9993	10.0000	1.0001	0.1001	0.0200	6/1/10	14:45	ATM	28.22	57.5	70	46	119
Yes	Yes	134.9990	99.9990	9.9999	1.0001	0.1000	0.0199	6/2/10	1602	ATM	28.09	61	75	46	118
Yes	Yes	134.9989	99.9989	9.9999	0.9999	0.1000	0.0201	6/3/10	1450	ATM	28.20	57	69	46	120
Yes	No	134.9991	99.9991	9.9999	1.0000	0.1001	0.0199	6/4/10	0950	ATM	28.09	55	68	42	120
Yes	No	134.9989	99.9990	9.9999	0.9999	0.1000	0.0199	6/7/10	1350	ATM	28.40	60	72	49	119
Yes	No	134.9989	99.9990	9.9999	1.0000	0.1000	0.0199	6/10/10	1545	ATM	28.395	58	70	48	121
Yes	No	134.9990	99.9990	9.9999	1.0000	0.1000	0.0199	6/11/10	1440	ATM	28.57	61	74	46	120
Yes	No	134.9990	99.9991	9.9999	1.0000	0.1001	0.0200	6/13/10	2035	ATM	28.33	58	71	44	120
Yes	No	134.9991	99.9990	10.0000	1.0001	0.1001	0.0199	6/15/10	1438	ATM	28.28	59	72	45	120
Yes	No	134.9990	99.9990	10.0000	0.9999	0.1000	0.0199	6/22/10	2041	ATM	28.45	58	70	48	121
Yes	No	134.9993	99.9993	10.0000	1.0000	0.1000	0.0199	6/23/10	2230	ATM	28.45	64	77	48	118
Yes	Yes	134.9989	99.9989	9.9999	0.9999	0.1000	0.0199	6/24/10	1710	ATM	28.29	60	74	43	117
Yes	Yes	134.9989	99.9989	9.9999	0.9999	0.0999	0.0199	6/29/10	1407	ATM	28.20	61	74	47	119
Yes	Yes	134.9989	99.9989	9.9999	1.0001	0.1001	0.0199	7/5/10	1705	ATM	28.38	58	70	48	118
YES	Yes	134.9989	99.9989	9.9999	0.9999	0.1000	0.0199	7/6/10	1250	JRP	28.48	57	68	50	118
Yes	Yes	134.9988	99.9989	9.9999	1.0000	0.1000	0.0199	7/6/10	1630	ATM	28.52	58	70	48	121
Yes	Yes	134.9988	99.9989	9.9999	1.0000	0.0999	0.0199	7/9/10	0645	ATM	28.52	58	70	48	120
Yes	No	134.9992	99.9992	9.9999	1.0000	0.1000	0.0199	7/8/10	1409	ATM	28.43	64	77	49	117
Yes	No	134.9991	99.9992	9.9999	1.0000	0.1000	0.0199	7/10/10	2145	ATM	28.04	61	74	46	119
Yes	No	134.9991	99.9992	9.9999	1.0000	0.1000	0.0199	7/12/10	1109	ATM	27.95	60	72	48	119
Yes	Yes	134.9988	99.9989	9.9999	1.0000	0.1000	0.0199	7/13/10	1426	ATM	28.35	55	67	45	119
Yes	No	134.9988	99.9989	9.9999	1.0001	0.1001	0.0200	7/14/10	1444	ATM	28.48	58	70	48	118
Yes	No	134.9988	99.9989	9.9999	1.0000	0.1000	0.0199	7/15/10	1128	ATM	28.43	60	73	46	118
Yes	NO	134.9989	99.9990	9.9999	0.9999	0.1000	0.0199	7/16/10	1810	ATM	28.28	61	75	44	117
Yes	NO	134.9989	99.9990	9.9999	0.9999	0.0999	0.0199	7/17/10	1800	ATM	28.29	60	73	46	120
Yes	No	134.9991	99.9991	10.0000	1.0000	0.1000	0.0199	7/18/10	2015	ATM	28.25	61	74	47	120
Yes	No	134.9989	99.9990	9.9999	1.0000	0.1000	0.0199	7/19/10	1040	ATM	28.40	60	73	46	119

From: 4/4/10
Through: 5/18/10

Woodstove Data Sheet 4-4 S[illegible]e QC Record Sheet

Scale 1

Scale: Sartorius
Model: CP224S
SN: 17050374
Rev: 3/10

* 135.0009 = 100.0000 + 10.0000 + 10.0000 + 5.000 100g wt 99.9991 - 99.9990

Level	Racali-brated	135g * weight5	100g weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	NO	134.9993	99.9993	9.9999	1.0001	0.1000	0.0200	4/4/10	1836	ATM	28.03	57	70	44	
Yes	NO	134.9992	99.9992	9.9999	1.0000	0.10000	0.0199	4/5/10	1641	ATM	28.09	58	72	42	
Pons	Servicing with Grade			QC Services		Here		4/6/10	1000						LINE
Yes	Yes	134.9993	99.9992	9.9999	0.9999	0.1000	0.0200	4/6/10	1130	ATM	28.10	58	72	42	Volts
Yes	Yes	134.9992	99.9992	9.9998	0.9999	0.1000	0.0199	4/6/10	1601	ATM	28.08	60	75	40	
Yes	Yes		99.9988					4/13/10	0945	ATM	28.12	57	70	44	
Yes	Yes	134.9989	99.9990	10.0000	1.0001	0.1001	0.0199	4/13/10	1330	ATM	28.13	60	72	49	
Yes	YES	134.9985	99.9987	9.9998	0.9999	0.0999	0.0199	4/14/10	1445	JRP	28.27	59	71	48	118V
Yes	No	134.9988	99.9989	9.9999	1.0000	0.1001	0.0199	4/14/10	1752	ATM	28.34	60	74	43	120
YES	NO	134.9988	99.9989	9.9998	1.0000	0.1000	0.0199	4/15/10	1049	PDT	28.43	58	72	42	120V
Yes	No	134.9990	99.9990	9.9999	1.0001	0.1001	0.0200	4/15/10	1605	ATM	28.43	59	71	48	120
Yes	No	134.9992	99.9992	9.9999	1.0001	0.0999	0.0201	4/22/10	1250	ATM	28.23	62	75	47	121
Yes	No	134.9993	99.9993	10.0000	1.0000	0.1001	0.0199	4/24/10	1827	ATM	28.42	58	70	48	119
Yes	No	134.9990	99.9990	10.0000	1.0000	0.1001	0.0200	4/26/10	0921	ATM	28.39	60	74	43	120
Yes	Yes	134.9992	99.9992	9.9999	1.0000	0.0999	0.0199	4/28/10	1249	ATM	27.86	58	70	48	119
Yes	No	134.9992	99.9992	9.9999	0.9999	0.1000	0.0199	4/29/10	1535	ATM	28.08	60	74	43	119
Yes	No	134.9992	99.9992	9.9999	1.0001	0.1001	0.0199	4/30/10	1513	ATM	28.23	57	70	44	120
Yes	No	134.9993	99.9992	9.9999	1.0000	0.1000	0.0199	5/3/10	1511	ATM	27.98	57	70	44	119
Yes	No	134.9990	99.9990	9.9999	1.0001	0.1001	0.0200	5/4/10	2040	ATM	28.48	60	73	46	120
Yes	No	134.9992	99.9992	10.0000	1.0000	0.1000	0.0199	5/5/10	1100	ATM	28.43	61	75	44	117
Yes	Yes	134.9988	99.9989	9.9999	0.9999	0.1000	0.0199	5/6/10	0819	PDT	28.60	59	73	42	120
Yes	No	134.9991	99.9991	10.0000	1.0001	0.1000	0.0199	5/7/10	1600	ATM	28.	59	73	42	122
Yes	No	134.9991	99.9991	9.9999	1.0001	0.1001	0.0200	5/10/10	1140	ATM	28.28	59	71	48	120
Yes	No	134.9991	99.9990	9.9999	1.0000	0.1000	0.0199	5/11/10	1349	ATM	28.39	55	68	42	119
Yes	No	134.9989	99.9989	9.9999	0.9999	0.1000	0.0199	5/12/10	1314	ATM	28.34	60	73	46	120
Yes	No	134.9990	99.9990	10.0000	1.0000	0.1000	0.0200	5/13/10	1340	ATM	28.37	62	75	47	119
Yes	No	134.9989	99.9990	10.0000	1.0001	0.1000	0.0200	5/14/10	0630	ATM	28.31	58	71	44	120
Yes	NO	134.9991	99.9991	9.9999	1.0001	0.1000	0.0199	5/18/10	1445	ATM	28.24	60	72	49	120

WOODSTOVE DATA SHEET 4-4 SCALE QC RECORD SHEET

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

FROM: 01/19/2010 - 0739
THROUGH: 2/21/10

Level	Recali brated	130 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	2010 Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
Yes	Yes	139.9992	99.9993	9.9999	1.0000	0.1000	0.0199	1/19	0739	PDG	57	73	35
Yes	Yes	139.9991	99.9994	9.9999	1.0000	0.1000	0.0199	1-20	1427	JRP	57	70	41
Yes	Yes	139.9991	99.9992	9.9999	1.0000	0.1000	0.0199	1/21	0952	PDG	56	72	34
Yes	No	139.9992	99.9993	9.9999	1.0000	0.1000	0.0199	1-22	0719	JRP	55	69	39
Yes	Yes	139.9991	99.9992	9.9999	1.0000	0.1000	0.0199	1/25	1345	PDG	55	69	39
Yes	No	139.9991	99.9992	9.9999	1.0000	0.1000	0.0199	1/27	1345	ATM	59	74	40
Yes	No	139.9993	99.9994	10.0000	1.0001	0.1001	0.0200	1/30	0600	ATM	58	70	48
Yes	No	139.9993	99.9993	10.0000	1.0000	0.1000	0.0199	1/30	1121	PDG	58	74	36
Yes	No	139.9993	99.9994	9.9999	1.0000	0.1000	0.0199	1/31	1550	ATM	59	74	40
Yes	No	139.9992	99.9993	10.0000	1.0000	0.1000	0.0199	2/1	1055	ATM	57	70	41
Yes	No	139.9992	99.9993	9.9999	1.0000	0.1000	0.0199	2/2	1755	ATM	57	71	41
Yes	Yes	139.9991	99.9992	9.9999	1.0000	0.1000	0.0200	2/3	0521	ATM	59	72	43
Yes	No	139.9991	99.9992	10.0000	1.0001	0.1000	0.0199	2/3	1913	ATM	56	68	46
Yes	Yes	139.9991	99.9992	9.9999	1.0001	0.1001	0.0199	2/4	0514	ATM	60	74	43
Yes	Yes	139.9992	99.9993	9.9999	1.0000	0.1000	0.0199	2/5	0547	ATM	59	74	40
Yes	Yes	139.9991	99.9992	9.9999	0.9999	0.1000	0.0199	2/5	1940	ATM	57	69	47
Yes	No	139.9992	99.9993	10.0000	1.0001	0.1001	0.0199	2/6	1925	ATM	57	70	41
Yes	No	139.9992	99.9993	10.0000	1.0001	0.1001	0.0200	2/7	0755	ATM	57	70	41
Yes	Yes	139.9992	99.9992	10.0000	1.0001	0.1001	0.0200	2/8	0810	ATM	56	71	37
Yes	Yes	139.9992	99.9992	9.9999	1.0000	0.1001	0.0200	2/8	2110	ATM	56	69	43
Yes	Yes(*)	134.9992	99.9992	9.9999	0.9999	0.1000	0.0199	2/9	1936	ATM	57	70	41
Yes	Yes	134.9992	99.9992	9.9999	1.0001	0.1001	0.0199	2/10	0530	ATM	54	66	44
Yes	No	134.9992	99.9992	10.0000	1.0001	0.1001	0.0199	2/10	1935	ATM	55	67	45
Yes	No	134.9992	99.9992	9.9999	1.0000	0.1000	0.0199	2/11	1553	ATM	56	69	43
Yes	No	134.9993	99.9993	9.9999	1.0001	0.1001	0.0199	2/12	1910	ATM	53	64	46
Yes	No	134.9992	99.9992	10.0000	1.0001	0.1000	0.0199	2/13	1745	ATM	55	66	48
Yes	No	134.9992	99.9992	10.0000	1.0000	0.1000	0.0199	2/14	1905	ATM	55	66	46
Yes	No	134.9992	99.9992	10.0000	1.0000	0.1001	0.0199	2/15	1502	ATM	57	69	47
Yes	Yes	134.9991	99.9992	10.0000	1.0000	0.1000	0.0200	2/16	1909	ATM	55	67	45
Yes	No	134.9994	99.9993	10.0000	1.0000	0.1000	0.0199	2/18	1955	ATM	58	70	48
Yes	No	134.9992	99.9992	9.9999	1.0001	0.1001	0.0199	2/19	1704	ATM	56	69	43
Yes	No	134.9992	99.9992	9.9999	1.0000	0.1001	0.0200	2/20	1305	ATM	54	68	38
Yes	No	134.9993	99.9994	9.9999	1.0001	0.1000	0.0199	2/21	1541	ATM	56	68	46

* Switched to 20 mg wt. Weighing 100, 20, 10 & 5 together for 135.0000

Woodstove Data Sheet 4-4 Scale QC Record Sheet
Scale 2

From: 7/27/10
Through: _____

Scale: Sartorius
Model: CPA 2245
SN: 24850860
Rev: 5/10

2010

Level	Recalibrated	135g Weights	100g Weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9996	99.9995	9.9999	1.0000	0.1000	0.0200	7/27/10	2206	ATM	28.32	63	76	49	118
Yes	Yes	134.9996	99.9994	9.9999	0.9999	0.1000	0.0199	7/28/10	1340	ATM	28.34	64	77	49	11(
Yes	No	134.9996	99.9996	9.9999	1.0000	0.1000	0.0199	7/29	1330	ATM	28.41	64	77	49	45
Yes	NO	134.9995	99.9995	9.9999	1.0000	0.0999	0.0199	7/30	1639	ATM	28.25	64	77	49	11(
Yes	No	134.9994	99.9994	9.9999	0.9999	0.0999	0.0199	731	1020	ATM	28.29	58	72	42	11(
Yes	No	134.9995	99.9994	9.9999	1.0000	0.1000	0.0199	7/31	2005	ATM	28.22	64	77	49	119
Yes	No	134.9996	99.9994	9.9999	0.9999	0.0999	0.0199	8/1	0926	ATM	28.32	56	68	46	116
Yes	NO	134.9996	99.9994	9.9999	1.0000	0.1000	0.0199	8/1	2050	ATM	28.30	61	74	47	117
Yes	Yes	134.9995	99.9994	9.9999	0.9999	0.0999	0.0199	8/2	0759	ATM	28.40	58	70	48	117
yes	no	134.9994	99.9994	9.9999	1.0000	0.1000	0.0199	8/2	12:50	SEK	28.37	61	75	46	119
Yes	NO	134.9994	99.9994	9.9999	0.9999	0.1000	0.0199	8/3	1600	JRP	28.34	58	70	48	116
yes	no	134.9996	99.9995	9.9999	1.0000	0.1000	0.0199	8/4	10:20	SEK	28.43	54	66	44	118
Yes	NO	134.9994	99.9994	9.9999	1.0000	0.0999	0.0199	8/5	1000	JRP	28.33	56	67	49	119
yes	NO	134.9996	99.9994	10.0000	1.0000	0.1001	0.0199	8/6	11:24	SEK	28.21	58	72	41	119
Yes	YES	134.9995	99.9995	9.9999	0.9999	0.0999	0.0199	8/8	1446	JRP	28.21	60	73	46	118
Yes	NO	134.9995	99.9994	9.9999	0.9999	0.1000	0.0199	8/12	10:13	SEK	28.18	56	68	46	117
Yes	NO	134.9994	99.9995	9.9999	0.9999	0.0999	0.0199	8/14	1457	JRP	28.47	58	70	48	116
Yes	No	134.9995	99.9995	9.9999	1.0000	0.1000	0.0199	8/16	0743	ATM	28.41	56	68	46	119

Woodstove Data Sheet 4-4 Scale QC Record Sheet
Scale 2

From: 4/6/10
Through: 7/22/10

Scale: Sartorius
Model: CPA 2245
SN: 24850860
Rev: 5/10

* 135.0000 g ± /00.00004 20.0000+ 10.0013 +5.0000 2010

Level	Recali-brated	135g * Weights	100g Weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9998	99.9997	9.9999	1.0000	0.0999	0.0199	4/6	1601	ATM		60	75	40	
Yes	No	134.9994	99.9994	9.9999	1.0001	0.1001	0.0199	4/13	0945	ATM		57	70	44	
Yes	No	134.9996	99.9996	10.0000	1.0001	0.1001	0.0199	4/13	1338	ATM		60	72	48	
Yes	Yes	134.9993	99.9993	9.9998	0.9999	0.0999	0.0199	4/14	1445	JRP		59	71	48	
Yes	Yes	134.9994	99.9994	9.9998	0.9999	0.0999	0.0198	4/15	1048	PDG	28.43	58	72	42	
Yes	No	134.9996	99.9994	9.9999	1.0000	0.1000	0.0200	4/22	1455	ATM	28.13	62	75	47	
Yes	No	134.9996	99.9996	9.9999	1.0000	0.1000	0.0199	5/5	1100	ATM	28.43	61	75	44	117
Yes	No	134.9996	99.9995	9.9999	0.9999	0.1000	0.0199	5/7	1600	ATM		59	73	42	122
Yes	No	134.9996	99.9995	9.9999	1.0000	0.0999	0.0200	5/8	1140	ATM	28.28	59	71	48	120
Yes	No	134.9995	99.9994	9.9999	1.0000	0.1000	0.0199	5/11	1349	ATM	28.39	55	68	42	119
Yes	No	134.9995	99.9994	9.9999	0.9999	0.1000	0.0199	5/12	1314	ATM	28.34	60	73	46	120
Yes	No	134.9996	99.9995	9.9999	1.0000	0.1000	0.0199	5/13	1340	ATM	28.37	62	75	47	119
Yes	No	134.9996	99.9995	10.0000	1.0001	0.1001	0.0200	5/14	0630	ATM	28.31	58	71	44	120
Yes	Yes	134.9996	99.9994	9.9998	0.9999	0.1000	0.0199	6/2	1602	ATM	28.09	61	75	46	118
Yes	No	134.9996	99.9995	9.9999	1.0000	0.1000	0.0199	6/22	2041	ATM	28.45	59	70	48	121
Yes	Yes	134.9995	99.9994	9.9999	1.0000	0.1000	0.0199	6/27	1710	ATM	28.29	60	74	43	117
Yes	No	134.9994	99.9994	9.9999	1.0000	0.1010	0.0199	6/29/10	1407	ATM	28.20	61	74	47	119
Yes	NO	134.9993	99.9993	9.9998	1.0000	0.1000	0.0198	7/14/10	1640	PDG	28.41	62	75	49	118
Yes	No	134.9997	99.9996	9.9999	1.0000	0.1000	0.0199	7/15/10	1128	ATM	28.43	60	73	46	116
Yes	No	134.9996	99.9995	9.9999	1.0000	0.1000	0.0199	7/16/10	1810	ATM	28.28	61	75	44	117
Yes	No	134.9997	99.9996	9.9999	0.9999	0.0999	0.0199	7/17/10	1800	ATM	28.29	60	73	46	120
Yes	No	134.9996	99.9994	9.9999	1.0000	0.0999	0.0199	7/18/10	2015	ATM	28.25	61	74	47	120
Yes	No	134.9996	99.9995	9.9999	0.9999	0.1000	0.0199	7/19/10	1040	ATM	28.40	60	73	46	119
Yes	No	134.9996	99.9994	10.0000	1.0000	0.1000	0.0199	7/19/10	1810	ATM	28.36	62	75	47	118
Yes	No	134.9996	99.9995	9.9999	0.9999	0.0999	0.0199	7/20/10	1350	ATM	28.36	59	72	45	118
Yes	Yes	134.9995	99.9994	9.9999	1.0001	0.1001	0.0199	7/21/10	1715	ATM	28.22	63	77	45	117
Yes	No	134.9996	99.9994	9.9999	0.9999	0.0999	0.0199	7/22/10	1617	ATM	28.16	61	74	46	119
Yes	Yes	134.9994	99.9994	9.9999	0.9999	0.0999	0.0199	7/20/10	2141	ATM	28.15	62	76	45	120

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

Unit: Luma V.3
Run: EPA 2
Date: 7/15/10
Technicians: ATM JRA PDG IJM
Revised 12/09-Data Sheet #5

Filters

Filter # (front) 115 Beaker # 27 Final Wt. 72.3356 g
Final Wt. .6793 g MI 55 Tare Wt. 72.3304 g
Tare Wt. .6536 g Desc. Acetone Net Wt. .0052 g
Net Wt. .0257 g

Filter #(Rear) 114 Beaker # _____ Final Wt. _____ g
Final Wt. .6585 g MI _____ Tare Wt. _____ g
Tare Wt. .6550 g Desc. _____ Net Wt. _____ g
Net Wt. .0035 g

Acetone Blank Calculation: Blank Date: 7/13/10

Blank Beaker # 29 Final Wt. 71.5194 g
MI 50 Tare Wt. 71.5193 g
Desc. Acetone Net Wt. .0001 g
.0001 g/ 50 ml = .000002 g/ml

Blank Residue Value Calculation:

.000002 g/ml acetone X 55 ml acetone = .00011 g
Blank Residue Value

Total Particulate Catch Calculation:

Filter: .0257 g
Filter: .0035 g
Beakers: .0052 g - .00011 g = .005091 g
Total Catch Blank Residue Value

Total Catch = .03429 g
34.29 mg.

Unit: Kuuma V.3
Run # EPA 2
Date: 7/15/10
Technician: AM POG JRP
WST6-Form1, Rev 5/10

Miscellaneous Test Data
Woodstove Data Sheet #8

Useable Firebox Dimensions: See QC Section Useable Volume: 1.554 ft³

Dilution Tunnel Draft (If Applicable): Start: 0.000 Stop: 0.000 Avg: 0.000 in. H_2O

Test Chamber Air Velocity: 10 Start: 12 Stop: _____ Avg: 11.0 ft./m.

Wet Bulb/ Start: WB: 67 °F DB: 84 °F % Amb Moisture: 1.60 %RH: 40

Dry Bulb Stop: WB: 67 °F DB: 82 °F % Amb Moisture: 1.70 %RH: 45

X Ambient Moisture(%Vol.) = 1.65 % X Relative Humidty (%RH) = 42.5 %

Empty Stove Wt: ~~329.1~~ lbs.

Empty Stove Wt with Stack (inc oil seal) Wet: 543.1 lbs. Dry: 542.9 lbs. 544.4

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

Kindling Wt. Paper: 0.2 lbs. Wood: 3.4 lbs. Total: 3.6 lbs.

Pre Burn Fuel Wt. 8.692 + 8.978 + 8.898 Total: 26.568 lbs.

Total Kindling and Pre Burn Fuel Wt. 30.168 lbs.

Coal Bed Wt-lbs: Range(2.4 - 2.0) 545.3 - 544.9 lbs. Actual: 2.1 lbs. 545.0

Allowable Amount of Charcoal That Can Be Removed:

Coal Bed Wt. Range (2.4 (Upper Wt.) + 2.0 (Lower Wt.) /2) .25 = 0.5 lbs.

Test Fuel Wt-lbs: Ideal 10.9 lbs. Range: 11.9 - 9.8 lbs. Actual: 9.812 lbs.

Test Fuel Size (pcs.) (.75 x 1.5 x 5" Flanges): 14 Pcs. 1.418 lbs.

2 x 4's x 14.0" " 3 Pcs. 6.096 lbs. 62.13 %

4 x 4's x 14.0" " 1 Pcs. 3.716 lbs. 37.87 %

3.7158 kg

Est. Dry Burn Rate(Kg/Hr.) 9.812 - (9.812 x .165 112) X 60 = 0.9693

2.2046 280 Dry Burn Rate (Kg/Hr)

Est EPA Heat Output (HO_E)(Avg BTU's/Hr) (19,140) X 63 x ____ = 11,689

100 EPA Heat Output (HO_E)BTU's/Hr

Stove Operating Data
Woodstove Test Data Sheet #9
Cold Start

Unit: Kuma V.3
Run: EPA 2
Date: 7/15/10
Technician(s): ATM JRP PDG
Data Sheet #9 - Rev 1/98-Pg.1

Fire Started: 10:00

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 1.4375" (Stop) 2.7785" ON Rod. At the run setting until the start of the test.

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 20 seconds.

Test: Door wide open during loading 0 min 51 sec, then closed to cracked open position until 1:30. Door opening monitored and adjusted to maximize the improvement of air flow on coal bed.

Primary Air: Wide open from the start of the test (0:00) until 4:55.
Adjusted to the run setting of 1.4375" between 4:55 and 5:00.
At the run setting of 1.4375" OPEN at 5:00 into the run.

Secondary Air: No Controls, Naturally drafted

Secondary Burn/~~Bypass~~: N/A
OFF during warmup. ON Low at start of preburn.

Fan: ON till Start of Test, Off at the start of the test, ~~off~~ for the 1st 30 minutes of the test. On low at 30 minutes, On for the rest of the test.

Test Run Anomalies:

None

Unit Kuma V.3
Run # EPA 2
Date 7/15/10
Technician ADM
Page 1 of ____
WST7-Form2-A, Rev 12/09

Woodstove Operating Data
Woodstove Data Sheet # 9A-1

Wood Data: Kindling: A mix of the below grades

	Size	Mill	Grade	Species
Pre Burn	2X4	Manke Tacoma	Std & BTR #2	D. Fir Std Grn
Test Fuel	2X4	Manke Tacoma	#2, Std & BTR	D. Fir Std Grn
	4X4	Manke Tacoma	#1, Std & BTR	D. Fir Std Grn

All grades WCLB Rules Unless otherwise noted

Warm Up Information:

1st Warm Up/Pre Burn Fuel Charge (8.682 lbs) added at 10:19.
2nd Warm Up Pre Burn Fuel Charge (8.978 lbs) added at 11:15.
3rd Warm Up/Pre Burn Fuel Charge (8.898 lbs) added at 12:03.
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 _____.

The coals were scooped out of the stove immediately prior to adding the 3rd pre burn/warm up fuel charge. The stove lost 0.2 lbs. 1.5 lbs of hot coals were put back in the stove.

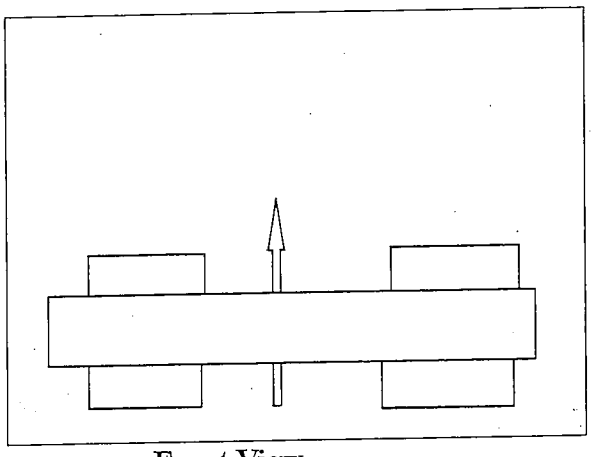
All pre burn/warm up fuel pieces were either ____ or 12 inches long. All pre burn pieces/fuel charges were "ricked" in the stove. The pieces in the bottom layer in each rick contained 2 pieces that were 12 inches long and were loaded flat and perpendicular to the door. The pieces in the second layer in each rick were loaded on their side (edge) approximately parallel to the door and contained 3 pieces 12 inches long. The third layer (and fourth layer if present) was loaded flat, perpendicular to the door and contained 2 pieces 12 inches long. The majority of the pieces in each rick were in the second layer. (The loading directions indicate the direction of the longest dimension on each piece relative to the loading door opening.) Note 3rd rick had 6-12" 2X4's 2 in bottom Layer, 2 in 2nd layer & 2 in third layer.

Unit Kuma V.3
Run # EPA 2
Date 7/15/10
Technician AM JRP PDC
Page 2 of _____
WST7-Form 2A, Rev 12/09

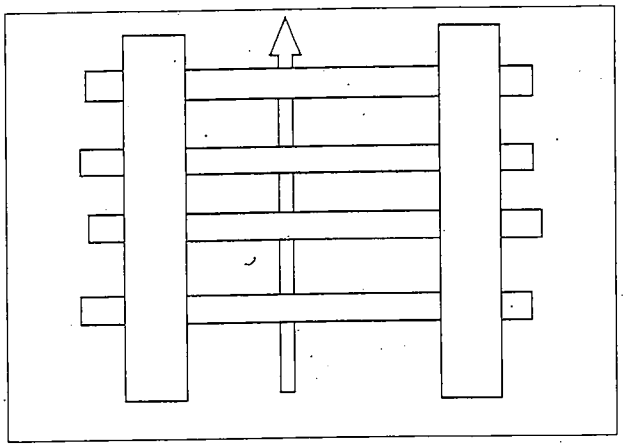
Wood Stove Operating Data
Wood Stove Data Sheet #9A-2

Warm Up Information (cont.):

Each warm up/preburn fuel charge was ricked in exactly (as much as possible) the same manner. The physical arrangement and alignment of the pieces in 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 collapsed or fallen down state) until 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 hot as quickly as possible during the warm up period, thereby maximizing the amount of heat (BTU's) stored in the stove. For this stove, the thermal storage was monitored using the TOP (#4) 994 _____ surface temperature (s) and the peak value (s) obtained were 1103 °F 1103



Front View



Top View

The arrows indicate the direction of the air flow through the rick. Note: The top and bottom layers may be offset

The primary air was adjusted to the run setting of 1 7/16" open 1.5 lbs above the upper charcoal bed weight. L = 2.7785" on Rod 1

Unit: Kuma V3
Run #: EPA 2
Date: 7/15/10
Technician: AJM JRP PDG
Page 3 of _____
WST5-Form2, Rev 12/09

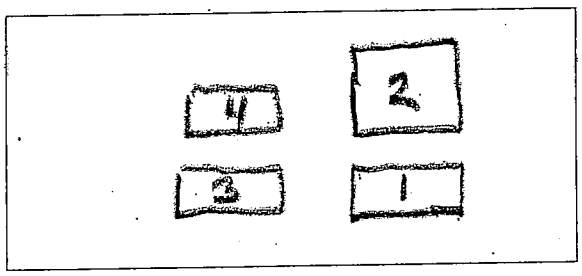
Woodstove Operating Data
Woodstove Data Sheet #9A-3

Additional Comments: Test Start Sequence: ① Turned Fan off, ② Adjusted PAC to write Open ③ Opened door ④ Loaded test fuel into stove ⑤ cleared coals away from air front of the load. ⑥ Closed the door to established open position.

Total Elapsed Time: 0151
Photo Taken @: 2:00

Test Fuel Charge Loading Information:

Test Fuel Charge and Loading Sequence Diagram



END of Stove View
4 X 4's: 2
2 X 4's: 1, 3, 4
Loading Sequence: 1, 2, 3, 4
Driest Pcs in Load 1, 3

Loaded the test fuel charge on an essentially level, Medium sized, Average to cool coal bed (in appearance, color and temperature) for a Low burn (≤10 kg/hr.) burn rate.

Ignition 0157 VC + baffle 1:30 - as soon as the door was closed.

<3:50 VC has spread over tops of 2 & 4
4:20 Secondaries/plumes occasionally past front tube.

Unit: Kuma V.3
Run: EPA 2
Date: 7/15/10
Technician: ATM

Fuel Moisture
Woodstove Test Data Sheet # 10

WST1-Form7-Rev 1/10

Room Temperature: 64.9 °F Correction Factor: +0.51

Scale Check
0.000 lb = 0.000
1 kg = 2.204 lb
5 kg = 11.024 lb.

Note: Record readings to the nearest 0.1% moisture
Uncor Values are corrected for temperature: Yes ____. No ✓
Time Test Fuel Moisture Readings Taken at: 1329
Moisture Meter: Delmhorst Model: J-2000 SN: 34284
Calibration Checks: 12.0 12.0 MCS-1: 12.8 12.8 23.7 23.8

PC #	Dimen	Use	Top	Bottom	Side	± Temp Cor	Piece Avg Corrected
1	3 pcs	K	8.9	9.1	8.6	+.51	9.377
2							
3							
4	2X4 - 8'	P	21.0	22.0	21.6	+.51	22.043
5	"	"	19.8	21.2	21.7	"	21.410
6	"	"	20.6	22.1	19.8	"	21.343
7	↓	↓	22.0	20.4	23.0	↓	22.310
8							87.106
9							
10	2X4 - 14"	T	18.7	18.7	19.1	+.51	19.343
11	"	"	19.7	18.7	18.9	"	19.610
12	"	↓	18.9	20.4	20.4	↓	20.410
13							
14	4X4 - 14"	T	19.2	19.9	18.6	+.51	19.743
15							79.106
16							
17	5x1.5x.75 (Spacers)	T	19	18.5	20	+.51	19.677
18							OUT Spacers
19							
20							

1.418

	Kindling	Pretest Fuel	Test Load
% Moisture – Dry Basis:	9.377 %	21.7765 %	19.7765 %
% Moisture – Wet Basis:	8.573 %	17.882 %	16.5112 %

To obtain Wet from Dry: 100 X % Dry Rdg. / 100 + % Dry Rdg. = % Moisture, Wet Basis

Acceptable Ranges: 16-20% wet; 19-25% dry

Key For Use: K= Kindling P= Pretest Fuel T= Test fuel

3.7156

1. 8,692 7 pcs
2. 8,978 7 "
3. 8,898 6 "
9.817

Unit: Kuma V.3
Run#: EPA 2
Date: 7/15/10
Technician: ATM

WOOD DENSITY DETERMINATION
WOODSTOVE TEST DATA SHEET #11

WST2-form11-Rev 6/90

Wood Piece: Nominal Dimensions: 2x4 — 3.4375 x 3.5 x 1.5

Depth (D): 8.890 cm

Width (W): 3.880 cm

Length (L): 8.76 cm, 8.765 cm, 8.765 cm, 8.795 cm

Length $\bar{X}$ = 8.77125 cm

Volume: 302.548 cm^3 (D X W X L)

MOISTURE: Room Temperature: 65.6 °F Correction Factor: +0.44

Uncorrected Meter Readings Corrected for temperature: Yes ___ No ✓

NOTE: Record moisture meter readings to the nearest 0.5%

	Uncor	Cor
Top:	19	19.9 %
Bottom:	—	8.5 %
Side:	—	9.3 %
$\bar{X}$:		12.567 % +0.44

Avg % Moisture (Dry) 13.007 %

Aug % Moisture (Wet) 11.510 %

Scale: Leveled In ✓ Out ✓

Zeroed: In ✓ Out ✓

Wet Weight: 201.5 g Dry Weight: 174.6 g

% Moisture Dried Basis: 13.350 %
[1 - (Dry Wt ÷ Wet Wt)] X 100

	Date	Time	Temp
Into Dryer	7/16/10	2022	190 °F
Out of Dryer	7/29/10	1123	207 °F

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

Density = 174.6 g (dry wt) ÷ 302.548 cm^3 (volume) = 0.5771 g/cm^3

Pellet Fuel Moisture Content Determination

Tare Beaker Wt. ___ g

Wet Wt: ___ g (Gross Wet Wt.) - ___ g (Tare Beaker Wt.) = ___ g (Net Wet Wt.)

Dry Wt: ___ g (Gross Dry Wt.) - ___ g (Tare Beaker Wt.) = ___ g (Net Dry Wt.)

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

Preburn Start Wt. 546.8 Lbs. Up 1.5 lbs.
Test Start Wt Range 545.3 - 544.9 lbs.
Baro. Pressure 28.37 "Hg

Pre Burn Data
Record Sheet #13

Unit: Kuma V.3 Date: 7/15/10
Run: EPA 2 Technician(s): ATM JRP S K
Page: 1 of 1 WST2-Form 16, Rev 12/09

* pushed stack probe Fully in.

Hot Box On ✓13 ✓17

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 Catalytic	11 Room Temp	Static		Comments
0	1238	546.8	0.0	348	996	639	633	632	442	1062	1439	82	-.072		Rake FWD @ 2.7785" ON Rod
5	43	546.3	.5	294	948	653	606	643	431	1040	1394	81	-.064		Primary Air Set At 1 7/16"
10	48	546.1	.2	252	864	665	581	652	424	1009	1232	81	-.056		Secondary Air Set At Fixed
15	53	545.9	.2	224	775	666	564	646	420	987	1222	81	-.051		Fan: On Low ✓
20	58	545.7	.2	214	725	661	550	638	416	965	1167	81	-.050		Tunnel on at:
25	1303	545.6	.1	202	677	652	537	626	411	940	1068	80	-.045	*	Buckets Iced ✓
30	08	545.5	.1	281	633	638	515	609	406	904	993	81	-.044		Analyzers Spanned ✓
35	13	545.4	.1	275	596	623	497	592	401	874	949	80	-.042		Pumps Turned on at: 24:25 min
40	18	545.3	.1	264	567	607	480	577	397	851	918	80	-.041	R	541.8 ΔT ΔΔT
45	23	545.3	.0	257	534	591	461	559	393	823	905	80	-.040		525.6 - 16.2
50	28	545.1	.2	251	519	575	441	542	387	805	918	80	-.036		507.6 - 18.0
55	33	545.0	.1	245	504	557	424	527	383	792	888	79	-.035		492.8 - 14.8
X														X	Tunnel ΔP - 13.8
															Probe In Tunnel
60	1338	545.0	0	241	495	546	415	517	377	785	875	79	-.034		470.0 ✓
65															
70															
75															
80															
85															
90															
95															
100															
105															
110															
115															

Myren C) lting Inc Data Sheet P1 of 4 Unit Kuma V.3 Date 7 / 13 / 10 Run ET 2

Test End vc. 545.0 AT 470.0 Barometric Pressure ____ ng Gas Flows @ 1.5" Technician(s) ATM JRP FOG

Time E/T min		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
0	1388	554.8	9.6	0	.278				.030	.36				Fan OFF	241	-.034
.05	43	554.3	9.3	.5	.227				.119	1.19			MS MH		340	-.051
10	48	554.0	9.0	.3	.233				.095	.95			ML→L		281	-.045
15	53	553.5	8.5	.5	.456				.091	.91			"		329	-.049
20	58	552.8	7.8	.7	.506				.105	1.05			L		353	-.055
25	1403	552.1	7.1	.7	.564	13.97		6.23	.121	1.21	11.5		"	main out	380	-.058
30	08	551.5	6.5	5/6	.590	14.61		5.54	.149	1.49	(9.5)	F	L-ML	Fan ON	387	-.059
35	13	550.8	5.8	.7	.619	15.33		4.57	.200	2.00	7.7		ML-M		395	-.060
40	18	550.2	5.2	.6	.619	15.33		4.81	.153	1.53	(10.0)		ML		392	-.060
45	23	549.7	4.7	.5	.595	14.74		5.52	.120	1.26	11.5		Light		383	-.057
50	28	549.3	4.3	.4	.555	13.75		6.61	.109	1.09	12.6		"		365	-.054
55	33	548.9	3.9	.4	.515	12.76		7.67	.093	.93	13.7		clear		350	-.052
Total															(4,196)	(-.634)

Time E/t		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	HB T2 17	cond T2 18
0	1388	495	546	415	517	377	785	875	79	96	222	39	79	57	230	36
05	43	469	521	401	499	403	718	821	80	107	227	36	81	37	230	36
10	48	484	513	388	492	408	680	740	79	107	226	36	83	37	214	36
15	53	597	488	362	472	414	674	1262	79	99	205	36	84	37	196	36
20	58	669	481	355	465	414	692	1198	80	101	205	37	85	37	233	37
25	1403	749	485	353	464	410	710	1230	80	105	221	37	85	37	238	37
30	08	790	495	357	466	407	726	1246	81	105	226	37	85	37	232	37
35	13	820	515	352	473	370	749	1236	81	104	227	37	84	37	215	38
40	18	833	533	351	460	352	771	1267	82	104	225	37	83	37	217	37
45	23	831	551	354	486	339	800	1331	82	103	224	37	83	37	229	38
50	28	812	564	360	496	333	823	1359	83	103	221	37	83	37	235	38
55	33	783	574	369	503	329	837	1345	82	102	220	37	83	37	229	38
Total		(8,332)	(6,266)	(4,417)	(5,815)	(4,556)	(8,965)	(13,930)	(968)							

Myren C. ulting Inc Data Sheet P2 of 4 Unit Kuma V13 Date 7/15/10 Run EPA 2

Test End Wt. 545.0 ΔT 470.0 Barometric Pressure ____ "hg Gas Flows @ 1.5" Technician(s) ATM JRP 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	1436	549.5	3.5	.4	.480	11.90		8.68	.063	.63	18.9	clear				332	-.050
65	43	548.3	3.3	.2	.433	10.74		9.86	.060	.60	17.9	W-L				313	-.047
70	48	548.0	3.0	.3	.409	10.15		10.45	.060	.60	16.9	clear				304	-.045
75	53	547.8	2.8	.2	.389	9.66		10.83	.082	.82	11.8	"				293	-.042
80	58	547.6	2.6	.2	.373	9.26		11.24	.079	.79	11.7					288	-.042
85	1503	547.4	2.4	.2	.384	9.53		11.00	.073	.73	13.1					280	-.042
90	08	547.2	2.2	.2	.442	10.96		9.73	.042	.42	26.1	"				295	-.043
95	13	547.0	2.0	.2	.397	9.85		10.64	.082	.82	12.0					285	-.041
100	18	546.8	1.8	.2	.365	9.07		11.41	.087	.87	10.4					267	-.038
105	23	546.7	1.7	.1	.340	8.45		11.97	.097	.97	(8.7)	wisps				253	-.035
110	28	546.5	1.5	.2	.302	7.51		12.77	.123	1.23	6.4	wisps				243	-.034
115	33	546.4	1.4	.1	.250	6.23		13.85	.163	1.63	3.8	wisps				235	-.033
Tot																3396	-.492

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	~~Tube 1~~ HB T2 #17	~~Tube 2~~ COND T2 #18	~~Tube 3~~ #19	H_2O H box #20
60	1436	741	581	378	510	327	847	1315	63	103	220	36	83	37	220	36		
65	43	700	584	386	514	325	850	1274	63	100	221	36	83	37	213	36		
70	48	673	582	396	515	326	846	1233	63	100	221	36	83	37	212	36		
75	53	650	575	390	514	326	836	1057	63	100	222	36	84	37	220	36		
80	58	634	567	387	511	329	828	1047	63	99	223	36	84	37	224	39		
85	1503	626	557	383	507	330	829	1119	63	99	222	38	84	38	225	39		
90	08	641	549	380	504	330	849	1196	63	100	222	36	85	36	223	39		
95	13	639	541	380	504	330	862	1164	63	100	222	38	85	38	222	39		
100	18	598	536	382	508	330	859	1043	64	99	221	36	84	38	221	39		
105	23	559	530	389	510	330	844	959	65	98	221	38	84	38	222	39		
110	28	530	523	393	510	330	827	920	63	96	221	36	84	38	224	39		
115	33	507	515	391	503	329	797	672	63	97	221	38	84	38	224	39		
Tot		7,498	6,640	4,629	6,108	3,944	10,074	13,219	994									

Myren Consulting Inc Data Sheet P3 of 4 Unit Kuma V1 Date 7 / 15 / 10 Run EPA 2

Test Engr. 545.0 ΔT 470.0 Barometric Pressure 28.32 "hg Gas Flows @ 1.5" Technician(s) ATM SRL 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	1538	546.4	1.4	0	.212	5.29		14.73	.176	1.76	3.0	clear				228	-.032
125	43	546.3	1.3	.1	.198	4.95		15.03	.184	1.84	2.7					222	-.030
130	48	546.2	1.2	.1	.201	5.02		14.90	.195	1.95	2.6					215	-.028
135	53	546.2	1.2	0	.200	5.00		15.02	.177	1.77	2.8					210	-.025
140	58	546.1	1.1	.1	.199	4.97		15.04	.178	1.78	2.8					205	-.027
145	1603	546.0	1.0	.1	.197	4.92		15.12	.171	1.71	2.9					201	-.025
150	08	546.0	1.0	0	.203	5.07		14.97	.172	1.72	2.9					197	-.025
155	13	545.9	.9	.1	.206	5.15		14.90	.171	1.71	3.0					194	-.024
160	18	545.9	.9	0	.213	5.32		14.77	.163	1.63	3.3					191	-.024
165	23	545.8	.8	.1	.216	5.39		14.70	.162	1.62	3.3					189	-.023
170	28	545.8	.8	0	.215	5.37		14.71	.165	1.65	3.3					187	-.023
175	33	545.7	.7	.1	.215	5.37		14.69	.166	1.66	3.2					185	-.023
Tot																2424	-.312

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	~~Cont. 2nd~~ HBT2 #17	~~Tube 1~~ COND T2 #18	Tube 2 4T #19	Tube 3 4AT #20
120	1538	490	509	387	496	329	763	833	84	97	221	38	84	38	225	39		
125	43	469	500	378	485	328	735	803	83	97	220	38	84	38	225	39		
130	48	450	489	369	472	326	713	782	84	96	221	38	84	37	225	39		
135	53	436	480	362	460	324	695	762	83	96	222	38	84	38	226	39		
140	58	423	470	356	449	321	678	746	83	96	223	38	84	37	225	39		
145	1603	411	462	353	436	319	660	737	83	95	223	38	84	38	224	39	396.6	-73.4
150	08	400	454	351	426	316	646	726	83	95	223	38	84	38	223	39		
155	13	392	446	350	416	312	637	720	83	95	223	38	84	37	222	39	383.6	-86.4
160	18	385	440	350	410	310	626	726	83	95	224	38	85	38	222	39	379.0	-91.0
165	23	379	434	351	403	307	617	726	83	95	224	38	85	38	222	40	374.8	-95.2
170	28	373	429	352	395	304	613	721	83	95	223	38	85	38	221	40		
175	33	369	425	353	390	303	606	715	83	94	223	38	86	38	221	40		
Tot		4977	5538	4312	5244	3799	7989	8999	998									

Myren Consulting Inc Data Sheet P4 of 4 Unit Kuma V.2 Date 7/15/10 Ru PPA2

Test F Wt. 545.0 ΔT 470.0 Barometric Pressure 28.3 "hg Gas Flows @ 1.5" Technician(s) Arm SDP, DO

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	1438	545.6	.6	.1	.214	5.34		14.72	.168	1.68	3.2					164	-.022
185	43	545.6	.6	0	.216	5.39		14.65	.171	1.71	3.2					161	-.022
190	48	545.5	.5	.1	.211	5.27		14.81	.165	1.65	3.2					160	-.021
195	53	545.5	.5	0	.218	5.44		14.64	.163	1.63	3.3					179	-.021
200	58	545.4	.4	.1	.220	5.49		14.59	.163	1.63	3.4					177	-.020
205	1703	545.3	.3	.1	.224	5.59		14.49	.164	1.64	3.4					176	-.020
210	08	545.3	.3	0	.229	5.71		14.34	.170	1.70	3.4					175	-.020
215	13	545.2	.2	.1	.237	5.91		14.12	.174	1.74	3.4					175	-.020
220	18	545.2	.2	0	.246	6.13		13.86	.176	1.76	3.5					174	-.019
225	23	545.1	.1	.1	.234	5.84		14.19	.174	1.74	3.4					174	-.019
230	28	545.0	0	.1	.226	5.64		14.34	.164	1.64	3.1					173	-.019
235																	
Tot												Total	11964	7.661			
												Avg ÷ 47	255	.035		1948	-.223

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
180	1438	366	422	353	386	301	603	701	63	94	223	38	86	36	221	40	365.6	-104.4
185	43	361	417	353	380	299	597	692	62	94	223	38	86	38	221	40	362.0	-108.0
190	48	358	414	350	377	297	594	693	62	94	223	38	87	36	221	40		
195	53	355	410	346	373	296	596	693	63	94	223	38	87	38	221	40	356.4	-113.6
200	58	352	406	347	371	295	596	694	63	94	222	36	87	38	220	40	354.2	-115.8
205	1803	349	402	347	369	294	600	696	62	94	222	38	87	38	220	40	352.2	-117.8
210	08	348	399	346	367	293	604	694	63	94	223	38	87	38	221	40	351.0	-119.0
215	13	347	397	350	366	292	612	696	63	94	223	38	87	38	221	40	350.4	-119.6
220	18	346	394	354	366	291	617	702	63	93	224	36	87	36	221	40	350.2	-119.8
225	23	346	393	357	367	289	615	695	63	93	224	39	87	38	221	40	350.4	-119.6
230	28	345	391	359	367	288	611	687	62	93	224	38	87	38	222	40	350.0	-120.0
235																		
Tot		3873	4445	3866	4089	3235	6647	7643	909								Start ΔT	470.0
									4090								End ΔT	350.0
Total		24180	22889	17224	21256	15534	33675	43791	3874								ΔΔT	-120.0
Avg ÷ 47		525	487	366	452	331	716	932	82									

Pre and Post Test Zero/Span Check
Woodstove Data Sheet # 15-3

Site: Myren Consulting, Colville, WA Date: 7/15/10 Analyte: CO

Source: Kuma U,3 Run #: EPA 2

Zero Cyl #: AA-9167 Conc. 00.0 % CO Cyl Press: 2075 psi

Certified By: Oxarc Date: 5/11/09

Span Cyl #: SY-45410 Conc. 2.55 % CO Cyl Press: 1525 psi

Certified By: Matheson TA Gas Date: 4/12/10

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

Range: 0 - 10.0% CO (0 – 5.0% CO) Analyzer Output: 0 – 1.0 v.

Flow: 1.5 SCFH Measured By: Rotameter: X Flowmeter: _____

EPA Span Values= 5.0% CO

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

Pre Run Audit: By: JRP Time: 1251 Temp: 81.2 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	0.00	0.000	.00716	+0.00716	+0.14
Span	2.55	.255	2.55	2.55	.255	2.5004	-0.04964	-1.95

Comments:

Post Run Audit: By: AA/Myren Time: 1816 Temp: 83.4 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	0.00	.000	.0076	+0.00716	+0.14
Span	2.55	.253	2.55	2.52	.252	2.4710	-0.07897	-3.10

Comments:

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

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

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

Pre and Post Test Zero/Span Check
Woodstove Data Sheet # 15-1

Site: Myren Consulting, Colville, WA Date: 7/15/10 Analyte: CO_2

Source: Kuma V.3 Run #: EPA 2

Zero Cyl #: AA-9167 Conc. 00.0 % CO_2 Cyl Press: 2075 psi

Certified By: Oxarc Date: 5/11/09

Span Cyl #: SX-45410 Conc. 12.6 % CO_2 Cyl Press: 1525 psi

Certified By: Matheson Tri Gas Date: 4/12/10

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 Values= 25.0% CO_2

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

Pre Run Audit: By: JRP Time: 1257 Temp: 84 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.100	0.000	.06655	+0.0655	+0.27
Span	50.0	.500	12.5	50.01	.504	12.4926	-0.1074	-0.85

Comments:

Post Run Audit: By: A.T. Myren Time: 1816 Temp: 83.4 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.00	.001	.09121	+0.09121	+0.36
Span	50.0	.500	12.5	50.5	.505	12.5173	-0.08275	-0.66

Comments:

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

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

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

Unit: Itumn U.3
Run: EPA 2
Date: 7/15/10
Technicians: A,TM
WST6-Form3, Rev 12/09

Quality Checks
Woodstove Data Sheet #16

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

Thermocouple Check (at ambient): T/C # 1: — °F; T/C#2: 69.7 °F
T/C # 3: 66.8 °F; T/C # 4: 66.6 °F; T/C #5: 67.4 °F;
T/C # 6: 67.6 °F; T/C # 7: 68.0 °F; T/C # 8: 67.6 °F;
T/C # 9: 70.8 °F; T/C # 10: 70.5 °F; T/C # 11: 66.2 °F;
T/C # 12: 68.4 °F; T/C # 13: 67.2 °F; T/C # 14: 62.7 °F;
T/C # 15: 64.1 °F; T/C # 16: 67.6 °F; T/C # 17: 65.6 °F;
T/C # 18: 64.4 °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	Adj	Post Test Check	%Difference
(0°F): 0.1 °F	to: — °F	Zero (0°F): 1.4 °F	+0.30
Span	Adj	Span	
(2000°F): 2000.6 °F	to: — °F	(2000°F): 2003.3 °F	+0.13

(Allowable % Difference = 1.5%. Use Formulas on Woodstove Data Sheet #15 to calculate % Difference, % Difference calculated 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 = 601.8 °F; 800°F = 801.8 °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 = 2000.7 °F

Combustion Gas (CO_2, O_2, CO) Train Leak Check: Pre ~~OK~~ JRP Post OK/PDG
Draft (Static) Guage Zero Check: Pre ~~OK~~ ✓ ATM, Post OK/ PDG
Scale Check Pre (Wt, #'s): 547.3 − 542.3 = 5.0 LBS / 5.0 LBS = OK ~~ATM~~ JRP
Post (Wt, #'s): 549.8 − 544.8 = 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 3 10 M LOW

DILUTION TUNNEL CALCULATIONS

MYREN CONSULTING CERTIFICATION TEST DATA

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

	6" Tunnel
File Name:	EPA 3
Manufacturer:	KUMA
Model Number:	V.3
Lab Name:	MYREN
Test Date:	7\16\10
Run Number:	EPA 3
Meter Box Y Factor:	1.0159
Barometric pressure (in):	28.259
Gas meter temp (ave):	**92**
delta H(avg):	**0.900**
Gas meter initial reading:	801.0010
Gas meter final reading:	896.0540
Front catch (acetone) mg:	4.69
first filter catch (mg):	16.9
second filter catch (mg):	0.3
Tunnel Flow (Qsd) (dscfm)	**146.655**
Emission Rate(g/hr):	**2.204**
Emission Rate(M5H) :	**3.507**
Avg. of Delta P Sq. Roots:	**0.2084**
Vs (Avg.)(ft/min):	**888.915**
Tunnel Avg. Temperature (F):	**109.368**
Test time(min):	180
Fuel Load(lb. wet):	9.820
Wood moisture(%wet):	16.648
Burn rate(dry kg/hr):	**1.238**
Sample Volume (dscf)	**87.399**
Avg. Tunnel Static (-inch H2O):	**0.1681**
Room Blank Catch (mg/dscf):	0
Emission Factor (g/kg):	**1.7808**
Pitot Correction Factor:	0.95821
front filter number	119
back filter number	118
Beaker Number:	34
PRELIMINARY RESULTS	
FINAL RESULTS:	AUDITED

DATA SUMMARY

MODEL:	V.3
RUN:	EPA 3
DATE:	7\16\10
DBR:	1.238
EMISSION RATE (g/hr)(M5H)	3.5068
EMISSION FACTOR (g/kg):	1.7808
AVG. % PROPORTIONALITY :	99.497

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	801.0010	74	0.900	849.19			0.163	0.2000	
10	0.043	117	806.2450	77	0.900	890.55	106.2	4.957	0.166	0.2074	
20	0.043	118	811.4380	81	0.900	891.32	103.7	4.872	0.165	0.2074	
30	0.043	119	816.6910	84	0.900	892.10	103.8	4.902	0.169	0.2074	
40	0.044	118	821.9320	88	0.900	901.63	100.8	4.855	0.168	0.2098	
50	0.044	116	827.1910	90	0.900	900.07	100.2	4.854	0.168	0.2098	
60	0.044	114	832.4730	92	0.900	898.51	99.8	4.857	0.168	0.2098	
70	0.043	112	837.7400	93	0.900	886.69	100.1	4.835	0.169	0.2074	
80	0.043	111	843.0310	94	0.900	885.91	100.1	4.848	0.167	0.2074	
90	0.044	110	848.3300	95	0.900	895.37	98.7	4.846	0.168	0.2098	
100	0.044	108	853.6240	96	0.900	893.80	98.1	4.833	0.170	0.2098	
110	0.044	107	858.9370	96	0.900	893.01	98.3	4.851	0.170	0.2098	
120	0.044	105	864.2520	97	0.900	891.44	98.0	4.852	0.168	0.2098	
130	0.043	104	869.5580	97	0.900	880.47	98.7	4.835	0.169	0.2074	
140	0.044	103	874.8530	99	0.900	889.86	96.6	4.808	0.170	0.2098	
150	0.044	103	880.1500	99	0.900	889.86	96.6	4.810	0.169	0.2098	
160	0.044	103	885.4500	99	0.900	889.86	96.7	4.813	0.169	0.2098	
170	0.044	104	890.7410	99	0.900	890.65	96.6	4.804	0.169	0.2098	
180	0.043	102	896.0540	99	0.900	878.91	98.0	4.824	0.169	0.2074	
190											
200											
210											
220											
230											
240											
250											
260											
270											
280											
290											
300											
310											
320											
330											
340											
350											
360											
370											
380											

CSA B415 PERCENT OVERALL EFFICIENCY SPREADSHEET DATA INPUTS

Manufacturer: Kuma
Model: Aspen
Date: 7/16/2010
Time: 180 mins
Category: 2 M Low
Run: EPA 3

%H20: 16.648%
Lbs. ; 9.820 lbs.

LHV %OE: 78.95%

HHV %OE: 73.04%

time	Lbs.	%CO	%CO2	%O2	Stack	Ambient
00	9.820	1.33	6.99	13.24	300	82
10	8.5	0.54	11.28	9.35	412	81
20	6.8	1.67	15.60	4.47	459	82
30	5.2	1.52	16.02	4.12	456	83
40	4.0	.97	14.66	5.75	432	84
50	3.3	.50	12.10	8.55	393	86
60	2.6	.20	12.32	8.48	378	84
70	2.1	.21	10.54	10.25	357	84
80	1.6	.32	9.07	11.67	339	84
90	1.4	1.20	6.30	14.00	307	85
100	1.2	1.27	6.16	14.11	290	85
110	1.1	1.28	5.56	14.70	276	84
120	.9	1.38	5.37	14.84	267	83
130	.8	1.42	5.02	15.17	257	84
140	.6	1.48	5.10	15.06	252	83
150	.5	1.18	5.33	14.97	248	85
160	.3	1.28	5.47	14.79	245	85
170	.2	1.22	5.42	14.87	241	85
180	0	1.25	5.42	14.86	238	84

MYREN CONSULTING, INC.
6 Inch Dilution Tunnel Traverse Data

Unit: Kuma V.3
Run #: EPA 3
Date: 7/16/10
Technicians: AIM JRP
Rev 2/22/09

Point	Location	Δp	$\sqrt{\Delta p_{trav}}$	$\sqrt{\Delta p_{cent}}$	#12 T_{trav}	#12 T_{cent}	Pg
W-1	0.5"	.035	.1871		107		
2	1.5	.044	.2098		107		
Center	Center	.043		.2074		108	-.170
3	4.5	.040	.2000		108		
4	5.5	.034	.1844		106		
S-1	0.5	.039	.1975		107		
2	1.5	.042	.2049		106		
Center	Center	.042		.2049		106	-.167
3	4.5	.041	.2025		107		
4	5.5	.038	.1949		107		
	Totals		1.5811	.4123	855	214	-.337
	Average		.1976	.2062	106.9	107	-.1685
	°R = (°F + 460)				566.9	567	

BP: 28.28 in. Hg Ps = BP+(Pg/13.6) = 28.28 + (-.1685/13.6) = 28.268 in. Hg

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

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

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

UNIT: Kuma V.3 DATE: 7/16/10 RUN #: EPA 3 TECHNICIAN(S): _____

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) (.1976 $\overline{X}$ $\sqrt{\Delta P}$ "H_2O") $\sqrt{\frac{566.9 \text{ Ts °A}}{\{0\}}}$ = 14.01406 fps

{2} {2} (28.268 Ps "Hg) (28.56 lb./ lb. mole) {2}

{2}

(9A) Vs = (14.01406 fps) (60) = 840.844 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) (.2062 $\overline{X}$ $\sqrt{\Delta P}$ "H_2O") $\sqrt{\frac{567 \text{ Ts °A}}{\{0\}}}$ = 14.62528 fps

{2} {2} (28.268 Ps "Hg) (28.56 lb./ lb. mole) {2}

{2}

(9A) Vs = (14.62528 fps) (60) = 877.517 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 = 14.01406 ÷ 14.62528 = 0.958210

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) (14.01406 fps) (.1963 ft^2) [(528 °A) (28.268 Ps "Hg) / (566.9 T_s °A) (29.92" Hg) =

{2} {3} {2} {0}

8,366.022 dscfhr (or dscfh)

{1}

(10A) 8,366.023 dscfhr ÷ 60 = 139.434 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.

M5G-1

Unit: Kuma V.2
Run: EPA 3
Date: 7/16/10
Page 1 of _____ Rev 5/10

Method 5G Particulate Sampling Data

Meter Box 45G-P Meter Y 1.0159 Filter #'s: (F) 119 (R) 118

Filter/O-Ring ID #: —

Pre Test Leak Check: .1001 CFM@ -16.2 in Hg Filter Size: 110 mm

.714/.1715

Probe ID #: —

Post Test Leak Check: .0015 CFM@ -15.3 in Hg Probe Length 21.5 in

.1116/.1165

Time		Meter Reading (ft³)	Pitot		Tunnel Temp (°F)	Meter Temp (°F)	Gas Meter Δh	Vac (in Hg)
Clock	Elapsed		ΔP	Pg				
1232	00	801.001	.040	-.163	104	74	0.90	0
42	10	806.245	.043	-.166	117	77	.90	0
52	20	811.438	.043	-.165	118	81	.90	0
1302	30	816.691	.043	-.169	119	84	.90	0
12	40	821.932	.044	-.168	118	88	.90	0
22	50	827.191	.044	-.168	116	90	.90	0
32	60	832.473	.044	-.168	114	92	.90	0
42	70	837.740	.043	-.169	112	93	.90	0
52	80	843.031	.043	-.167	111	94	.90	0
1402	90	848.330	.044	-.168	110	95	.90	0
12	100	853.624	.044	-.170	108	96	.90	0
22	110	858.937	.044	-.170	107	96	.90	0
32	120	864.252	.044	-.168	105	97	.90	0
42	130	869.558	.043	-.169	104	97	.90	0
52	140	874.853	.044	-.170	103	99	.90	0
1502	150	880.150	.044	-.169	103	99	.90	0
12	160	885.450	.044	-.169	103	99	.90	0
22	170	890.741	.044	-.169	104	99	.90	0
32	180	896.054	.043	-.169	102	99	.90	0
	90							

BP

00 28.28 ____ ____
60 28.27 ____ ____
120 28.245 ____ ____
180 28.24 ____ ____
____ ____ Avg. = 28.259

Pre Test Filter Check Weighing
F .6562
R .6564

.6731 .6567
End of Test Weight
F R
.6732 .6570
.6562 .6564
.0170 .6
.169 3

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

Into Dessicator; Date 11/20/09 Time 1026 By PDQ Front Half ✓ Back Half ✓

Manufacturer: PALL P/N 60115 Size: 110 mm Lot.No.: T72680 Grade: A/E GLASS

Filter #	First Wt	2010 Date	Time	By	Second Wt	2010 Date	Time	By	Third Wt	Date	Time	By
101	.6559	1/21	1103	PDQ	.6559	7/6	1802	ATM				
102	.6532		1104	PDQ	.6533		1800	ATM				
103	.6557		1105	PDQ	.6551		1801	ATM				
104	.6545		1106	PDQ	.6545		1800	ATM				
105	.6556		1107	PDQ	.6555		1759	ATM				
106	.6545		1108	PDQ	.6546		1758	ATM				
107	.6546		1109	PDQ	.6547		1757	ATM				
108	.6522		1110	PDQ	.6524		1756	ATM				
109	.6558		1111	PDQ	.6557		1755	ATM				
110	.6531		1112	PDQ	.6530		1754	ATM				
111	.6511		1113	PDQ	.6510		1753	ATM				
112	.6538		1114	PDQ	.6537		1752	ATM				
113	.6553		1115	PDQ	.6553		1751	ATM				
114	.6548		1115	PDQ	.6550		1750	ATM				
115	.6533		1116	PDQ	.6536		1749	ATM				
116	.6580		1117	PDQ	.6579		1748	ATM				
117	.6543		1116	PDQ	.6545		1747	ATM				
118	.6564		1119	PDQ	.6564		1747	ATM				
119	.6564		1120	PDQ	.6562		1746	ATM				
120	.6548		1121	PDQ	.6549		1745	ATM				
121	.6526		1122	PDQ	.6527		1744	ATM				
122	.6565		1123	PDQ	.6564		1743	ATM				
123	.6567		1124	PDQ	.6568		1743	ATM				
124	.6550		1125	PDQ	.6552		1742	ATM				
125	.6528	—	1126	PDQ	.6528	✓	1741	ATM				

Checked by AT MyNW Date: 7/6/10 Time 1805

QA REWEIGH

Filter #	WT	Date	Time	By
106	.6545	7/7/10	0657	JM
115	.6533	7/7/10	0658	JM
121	.6525	7/7/10	0659	JM

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	2010 Date	Time	By
56	72	34	11/21	0952	PDQ
58	70	48	7/6/2010	1630	ATM
58	70	48	7/7/10	0645	ATM

POST 1/21 7/6 7/16

0.0000 0.0000 0.0000

00.0000 99.9992 99.9990

Woodstove Data Sheet #4-2: Initial Beaker Weights (Tare Weights)

Into Dessicator: Date 7-12-10 Time 1313 By JRP

Balance Used: Sartorius 2 Model: ~~CP224S~~ CPA 225 SN: ~~17050374~~

Beaker #	First Wt	2010 Date	Time	By	Second Wt	2010 Date	Time	By	Third Wt	Date	Time	By
20	73.3182	7/14	1643	PDQ	73.3193	7/15	1419	JRP	73.3188	7/16	1824	
21	71.0024		1644	PDQ	71.0006	7/15	1417	JRP	71.0025	7/16	1823	
28	70.5972		1646	PDQ	70.5977	7/15	1415	JRP				
32	53.6005		1647	PDQ	53.6006	7/15	1414	JRP	53.6009	7/20	2221	
34	53.2616		1648	PDQ	53.2620	7/15	1412	JRP				
35	53.2815		1649	PDQ	53.2818	7/15	1210	ATM	53.2818	7/20	2218	
38	53.2525		1650	PDQ	53.2530	7/15	1209	ATM	53.2534	7/20	2220	
39	53.1509		1651	PDQ	53.1510	7/15	1206	ATM				
42	53.8698		1652	PDQ	53.8688	7/15	1147	ATM	53.8704	7/16	1820	
25	72.6522	7/20	2223		72.6522	7/27	2240	ATM				
Into Dessicator 7/16/10 @							1750	ATM				
41	52.8380	7/17	1843	ATM	52.8376	7/18	2045					
43	53.2328	7/17	1858	ATM	53.2328	7/18	2058					
29	71.5188	7/20	2223		71.5186	7/27	2246	ATM				
42	53.8703	7/17	1834	ATM	53.8686	7/27	2248	ATM				
21	71.0026	7/17	1837	ATM								
22	71.8334	7/20	2222		71.8330	7/27	2249	ATM				
Into Dessicator 7/12/10 @							1922	ATM				
31												
36	70.7848	7/20	2211		70.7854	7/27	2237	ATM				
40	53.4631	7/20	2212		53.4633	7/27	2236	ATM				
24	73.2483	7/20	2213		73.2181	7/27	2234	ATM				

Checked by _____ Date: _____ Time: _____

QA Reweigh

Beaker #	WT	Date	Time	By
28	70.5982	7/16	1824	

Balance Room Environmental Conditions

WB	DB	%RH	Date 2010	Time	By
62	75	46	7/14	1640	DDQ
60	73	46	7/15	1128	ATM
61	75	44	7/16	1810	ATM
60	73	46	7/17	1800	ATM
61	74	47	7/18	2015	ATM

62 76 45 7/20 2141 ATM

	Date	1st	2nd	3rd	4th	5th
Post Weighing	0.0000g	0.0000	0.0000	0.0000	0.0000	0.0000
Scale Check	100.0000g	99.9994	99.9994	99.9994	99.9995	99.9995

6th 0.0000

Woodstove Data Sheet #4-2: Initial Beaker Weights (Tare Weights)

Scale 2

Into Dessicator: Date 4 May 10 Time 0940 By ATM

Balance Used: Sartorius Model: CP224S SN: [redacted]

Beaker #	First Wt	Date	Time	By	Second Wt	2010 Date	Time	By	Third Wt	Date	Time	By
20	3171	5/5	1453	ATM	73.3176	5/7	1641					
21	.0018		1504	ATM	71.0022	5/7	1704		71.0018	5/8/10	1245	ATM
22	.8331		1503	ATM	71.8344	5/7	1705		71.8337	5/8/10	1246	ATM
23	.7386		1455	ATM	70.7392	5/7	1708		70.7395	5/8/10	1227	ATM
24	.2178		1456	ATM	73.2187	5/7	1700		73.2187	5/8/10	1229	ATM
25	.6518		1459	ATM	72.6516	5/7	1650		72.6511	5/11/10	1447	ATM
26	.7872		1507	ATM	71.7879	5/7	1647		71.7875	5/11/10	1438	ATM
27	.3304		1508	ATM	72.3311	5/7	1657		72.3305	5/8/10	1248	ATM
29	.5185		1510	ATM	71.5198	5/7	1656		71.5193	5/11/10	1543	ATM
30	.8558		1511	ATM	70.7856	5/7	1658		70.7855	5/11/10	1541	ATM
32	.5986		1506	ATM	53.5999	5/7	1702		53.5996	5/8/10	1235	ATM
33	.1475		1505	ATM	53.1488	5/7	1701		53.1484	5/11/10	1437	ATM
36	.5736		1501	ATM	53.5747	5/7	1707		53.5742	5/8/10	1238	ATM
38	.2513		1500	ATM	53.2523	5/7	1703		53.2520	5/8/10	1239	ATM
40	.4617		1457	ATM	53.4625	5/7	1706		53.4624	5/8/10	1236	ATM
41	.8355		1458	ATM	52.8364	5/7	1707		52.8368	5/8/10	1229	ATM
43	.2319	↓	1440	ATM	53.2323	5/7	1640					
31	.6666	5/7/10	1655		69.6666	6/11	1445	ATM				
37	53.7263	5/7/10	1646		53.7259	6/11	1440	ATM				
(Cont)												
22	.8338	5/11/10	1623									
27	.3287	5/11/10	1622		72.3305	6/12/10	1500	ATM	72.3304	6/2/10	1620	

Blank

Checked by ATM Date: 6/2/10 Time: 1610

QA Reweigh

Beaker #	WT	Date	Time	By
22	71.8339	6/2/10	1617	ATM
32	53.5997	6/2/10	1619	
21	71.0023	6/2/10	1620	

Balance Room Environmental Conditions

WB °F	DB °F	%RH	Date 5/5	Time 0940	By ATM
59	73	42	5/7/10	1600	ATM
59	71	48	5/8/10	1140	ATM
55	69	42	5/11/10	1349	ATM
60	73	46	5/12/10	1314	ATM
61	75	45	6/2/10	1602	ATM

Post Weighing	Date	1st	2nd	3rd	4th	5th	6th
	0.0000g	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Scale Check	100.0000g	99.9996	99.9995	99.9995	99.9995	99.9995	99.9995

Woodstove Data Sheet #4-3: Constant Final Weights

MSG-1

Unit Kuma V.3
Run # EPA 3
Date: 7/16/10

55 ml

WST5-Form 9, Pg 1, Rev 5/10

Final Beaker Weights

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
34	53.2654	7/17	1908	ATM	53.2684	7/18	2048		53.2672	7/19	1114	ATM	53.2666	7/20	2132	
					53.2681	7/20	2202	ATM	53.2669	7/27	2259	ATM	53.2670	7/28	1434	
					53.2668	7/27	1304	ATM	X							

Final Filter Weights

	Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
F	119	.6732	7/16	1604	ATM	.6728	7/17	1826	ATM	(.6731)	7/18	2054		X			
											7/18	2055					
R	118	.6570	7/16	1604	ATM	.6568	7/17	1830	ATM	(.6567)				X			

QA Reweigh: Final Weight

Date	Beaker #	Final Wt	By

Date	Filter #	Final Wt	By

Scale Room Environmental Conditions

Weighing Session	2010 Date	Time	By	WB	DB	%RH
1	7/17	1800	ATM	60	73	46
2	7/18	2015	ATM	61	74	47
3	7/19	1040	ATM	60	73	46
4	7/20	1350	ATM	59	72	45
5	7/26	2141	ATM	62	76	45
6	7/27	2206	ATM	63	76	49

Scale Room Environmental Conditions

7	7/28	1240	AM	64	77	49
8	7/29	1320	AM	64	74	49
9						
10						
11						

Comments

Acetone Blank 7/13/10
BLR 29 50ml Acetone
Lot # 074092 Tare Wt. 71.5193

Woodstove Data Sheet #4-3: Constant Final Weights

Kuma

Unit Kuma #3
Run # EPA 3
Date: 7-16-10

WST5-Form 9, Pg 1, Rev 5/10

Final Beaker Weights

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
29	71.5194	7/30	1546	AM	71.5180	7/31	1111	ATM	71.5195	7/31	2028	JL	71.5194	8/1	0941	ATM

Final Filter Weights

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

QA Reweigh: Final Weight

Date	Beaker #	Final Wt	By

Date	Filter #	Final Wt	By

Scale Room Environmental Conditions

Weighing Session	2010 Date	Time	By	WB	DB	%RH
1	7/31	1020	ATM	58	72	42
2	7/31	2005	ATM	64	77	49
3	8/1	0936	ATM	64	77	49
4						
5						
6						

Scale Room Environmental Conditions

7					
8					
9					
10					
11					

Comments

Woodstove Data Sheet 4-4 Scale QC Record Sheet

Scale 1

From: 7/20/10
Through:

Scale: Sartorius
Model: CP224S
SN: 17050374
Rev: 3/10

* 135.0000 g = 100.0000 + 20.0000 + 10.0000 + 5.0000 wts, 100g wt = 99.9991 - 90

Level	Recalibrated	130g * Weights	100g Weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	2010 Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9988	99.9989	9.9999	1.0000	0.1000	0.0199	7/20	1350	ATM	28.36	59	72	45	118
Yes	Yes	134.9988	99.9989	9.9999	0.9999	0.0999	0.0199	7/21	1715	ATM	28.22	63	77	45	117
Yes	No	134.9988	99.9989	10.0000	1.0000	0.1000	0.0199	7/22	1617	ATM	28.16	61	74	46	119
Yes	Yes	134.9989	99.9990	9.9999	1.0000	0.0999	0.0199	7/26	2141	ATM	28.15	62	76	45	120
Yes	No	134.9990	99.9991	9.9999	1.0000	0.0999	0.0199	7/27	2006	ATM	28.32	63	76	49	119
Yes	No	134.9991	99.9992	9.9999	1.0000	0.1000	0.0199	7/28	1340	ATM	28.34	64	77	49	116
Yes	No	134.9989	99.9990	9.9999	1.0001	0.1001	0.0200	7/29	1330	ATM	28.41	64	77	49	115
Yes	No	134.9990	99.9991	9.9999	1.0000	0.1000	0.0199	7/30	1639	ATM	28.25	64	77	49	116
Yes	No	134.9989	99.9989	9.9999	0.9999	0.0999	0.0199	7/31	1020	ATM	28.29	58	72	42	116
Yes	No	134.9990	99.9991	9.9999	1.0000	0.1000	0.0199	7/31	2005	ATM	28.22	64	77	49	119
Yes	Yes	134.9988	99.9989	9.9999	0.9999	0.1000	0.0199	8/1	0926	ATM	28.32	56	68	46	116
Yes	No	134.9988	99.9989	9.9999	1.0001	0.0999	0.0199	8/1	2050	ATM	28.30	61	74	47	117
Yes	Yes	134.9988	99.9989	9.9999	1.0001	0.1000	0.0199	8/2	0756	ATM	28.40	59	70	48	117
Yes	Yes	134.9988	99.9989	9.9999	1.0000	0.1001	0.0199	8/3	1600	JRP	28.34	58	70	48	116

Woodstove Data Sheet 4-4 Scale QC Record Sheet All Scales and Desiccators Individually Grounded Now.

Scale 1

From: 5/31/10
Through: 7/19/10

Scale: Sartorius
Model: CP224S
SN: 17050374
Rev: 3/10

* 135.0000g = 100.0000 + 20.0000 + 10000 + 5.000 wts. 100g WT = 99.9991-99.9990

Level	Recalibrated	130g* Weights	100g Weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9992	99.9992	9.9999	1.0001	0.1001	0.0200	5/31/10	10:45	ATM	28.21	58	70	48	120
Yes	No	134.9992	99.9993	10.0000	1.0001	0.1001	0.0200	6/1/10	14:45	ATM	28.22	57.5	70	46	119
Yes	Yes	134.9990	99.9990	9.9999	1.0001	0.1000	0.0199	6/2/10	1602	ATM	28.09	61	75	46	118
Yes	Yes	134.9989	99.9989	9.9999	0.9999	0.1000	0.0201	6/3/10	1450	ATM	28.20	57	69	46	120
Yes	NO	134.9991	99.9991	9.9999	1.0000	0.1001	0.0199	6/4/10	0950	ATM	28.09	55	68	42	120
Yes	No	134.9989	99.9990	9.9999	0.9999	0.1000	0.0199	6/7/10	1350	ATM	28.40	60	72	49	119
Yes	No	134.9989	99.9990	9.9999	1.0000	0.1000	0.0199	6/10/10	1545	ATM	28.395	58	70	48	121
Yes	No	134.9990	99.9990	9.9999	1.0000	0.1000	0.0199	6/11/10	1440	ATM	28.57	61	74	46	120
Yes	No	134.9990	99.9991	9.9999	1.0000	0.1001	0.0200	6/13/10	2035	ATM	28.33	58	71	44	120
Yes	No	134.9991	99.9990	10.0000	1.0001	0.1001	0.0199	6/15/10	1438	ATM	28.28	59	72	45	120
Yes	NO	134.9990	99.9990	10.0000	0.9999	0.1000	0.0199	6/22/10	2041	ATM	28.45	58	70	48	121
Yes	NO	134.9993	99.9993	10.0000	1.0000	0.1000	0.0199	6/23/10	2230	ATM	28.45	64	77	48	116
Yes	Yes	134.9989	99.9989	9.9999	0.9999	0.1000	0.0199	6/27/10	1710	ATM	28.29	60	74	43	117
Yes	Yes	134.9989	99.9989	9.9999	0.9999	0.0999	0.0199	6/29/10	1407	ATM	28.20	61	74	47	119
Yes	Yes	134.9989	99.9989	9.9999	1.0001	0.1001	0.0199	7/5/10	1705	ATM	28.38	58	70	48	118
YES	Yes	134.9988	99.9989	9.9999	0.9999	0.1000	0.0199	7/6/10	1250	JRP	28.48	57	68	50	118
Yes	Yes	134.9988	99.9989	9.9999	1.0000	0.1000	0.0199	7/6/10	1630	ATM	28.52	58	70	48	121
Yes	Yes	134.9988	99.9989	9.9999	1.0000	0.0999	0.0199	7/7/10	0645	ATM	28.52	58	70	48	120
Yes	No	134.9992	99.9992	9.9999	1.0000	0.1000	0.0199	7/8/10	1409	ATM	28.43	64	77	49	117
Yes	No	134.9991	99.9992	9.9999	1.0000	0.1000	0.0199	7/10/10	2145	ATM	28.04	61	74	46	119
Yes	NO	134.9991	99.9992	9.9999	1.0000	0.1000	0.0199	7/12/10	1109	ATM	27.95	60	72	48	119
Yes	Yes	134.9988	99.9989	9.9999	1.0000	0.1000	0.0199	7/13/10	1426	ATM	28.35	55	67	45	119
Yes	No	134.9988	99.9989	9.9999	1.0001	0.1001	0.0200	7/14/10	1444	ATM	28.48	58	70	48	118
Yes	No	134.9988	99.9989	9.9999	1.0000	0.1000	0.0199	7/15/10	1128	ATM	28.43	60	73	46	118
Yes	NO	134.9989	99.9990	9.9999	0.9999	0.1000	0.0199	7/16/10	1810	ATM	28.28	61	75	44	117
Yes	NO	134.9989	99.9990	9.9999	0.9999	0.0999	0.0199	7/17/10	1800	ATM	28.29	60	73	46	120
Yes	No	134.9991	99.9991	10.0000	1.0000	0.1000	0.0199	7/18/10	2015	ATM	28.25	61	74	47	120
Yes	NO	134.9989	99.9990	9.9999	1.0000	0.1000	0.0199	7/19/10	1040	ATM	28.40	60	73	46	119

Woodstove Data Sheet 4-4 Scale QC Record Sheet

Scale 1

From: 4/4/10
Through: 5/18/10

Scale. Sartorius
Model: CP224S
SN: 17050374
Rev: 3/10

* 135.0009 = 100.0000 + 10.0000 + 10.0000 + 5.000 100g wt 99.9991 - 99.9990

Level	Racali-brated	130g * weight5	100g weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	NO	134.9993	99.9993	9.9999	1.0001	0.1000	0.0200	4/4/10	1836	ATM	28.03	57	70	44	
Yes	NO	134.9992	99.9992	9.9999	1.0000	0.10000	0.0199	4/5/10	1641	ATM	28.09	58	72	42	
Pans	Serviced with Check			QC Services		Here		4/6/10	1000						LINE
Yes	Yes	134.9993	99.9992	9.9999	0.9999	0.1000	0.0200	4/6/10	1130	ATM	28.10	58	72	42	Volts
Yes	Yes	134.9992	99.9992	9.9998	0.9999	0.1000	0.0199	4/6/10	1601	ATM	28.08	60	75	40	
Yes	Yes		99.9988					4/13/10	0945	ATM	28.12	57	70	44	
Yes	Yes	134.9989	99.9990	10.0000	1.0001	0.1001	0.0199	4/13/10	1338	ATM	28.13	60	72	49	
Yes	YES	134.9985	99.9987	9.9998	0.9999	0.0999	0.0199	4/14/10	1445	JRP	28.27	59	71	48	118V
Yes	No	134.9988	99.9989	9.9999	1.0000	0.1001	0.0199	4/14/10	1752	ATM	28.34	60	74	43	120
YES	NO	134.9988	99.9989	9.9998	1.0000	0.1000	0.0199	4/15/10	1049	PDG	28.43	58	72	42	120V
Yes	No	134.9990	99.9990	9.9999	1.0001	0.1001	0.0200	4/15/10	1605	ATM	28.43	59	71	48	120
Yes	No	134.9992	99.9992	9.9999	1.0001	0.0999	0.0201	4/22/10	1250	ATM	28.23	62	75	47	121
Yes	No	134.9993	99.9993	10.0000	1.0000	0.1001	0.0199	4/24/10	1827	ATM	28.42	58	70	48	119
Yes	No	134.9990	99.9990	10.0000	1.0000	0.1001	0.0200	4/26/10	0921	ATM	28.39	60	74	43	120
Yes	Yes	134.9992	99.9992	9.9999	1.0000	0.0999	0.0199	4/28/10	1249	ATM	27.86	58	70	48	119
Yes	No	134.9992	99.9992	9.9999	0.9999	0.1000	0.0199	4/29/10	1535	ATM	28.08	60	74	43	119
Yes	No	134.9992	99.9992	9.9999	1.0001	0.1001	0.0199	4/30/10	1513	ATM	28.23	57	70	44	120
Yes	No	134.9993	99.9992	9.9999	1.0000	0.1000	0.0199	5/3/10	1511	ATM	27.98	57	70	44	119
Yes	No	134.9990	99.9990	9.9999	1.0001	0.1001	0.0200	5/4/10	2040	ATM	28.48	60	73	46	120
Yes	No	134.9992	99.9992	10.0000	1.0000	0.1000	0.0199	5/5/10	1100	ATM	28.43	61	75	44	117
Yes	Yes	134.9988	99.9989	9.9999	0.9999	0.1000	0.0199	5/6/10	0819	PDG	28.60	59	73	42	120
Yes	No	134.9991	99.9991	10.0000	1.0001	0.1000	0.0199	5/7/10	1600	ATM	28.	59	73	42	122
Yes	No	134.9991	99.9991	9.9999	1.0001	0.1001	0.0200	5/8/10	1140	ATM	28.28	59	71	48	120
Yes	No	134.9991	99.9990	9.9999	1.0000	0.1000	0.0199	5/11/10	1349	ATM	28.39	55	68	42	119
Yes	No	134.9989	99.9989	9.9999	0.9999	0.1000	0.0199	5/12/10	1314	ATM	28.34	60	73	46	120
Yes	No	134.9990	99.9990	10.0000	1.0000	0.1000	0.0200	5/13/10	1340	ATM	28.37	62	75	47	119
Yes	No	134.9989	99.9990	10.0000	1.0001	0.1000	0.0200	5/14/10	0630	ATM	28.31	58	71	44	120
Yes	NO	134.9991	99.9991	9.9999	1.0001	0.1000	0.0199	5/18/10	1445	ATM	28.24	60	72	49	120

WOODSTOVE DATA SHEET 4-4 SCALE QC RECORD SHEET

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

FROM: 01/19/2010 - 0739
THROUGH: 2/21/10

Level	Recalibrated	130 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	2010 Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
Yes	Yes	139.9992	99.9993	9.9999	1.0000	0.1000	0.0199	1/19	0739	PDG	57	73	35
Yes	Yes	139.9991	99.9994	9.9999	1.0000	0.1000	0.0199	1-20	1427	JRP	57	70	41
Yes	Yes	139.9991	99.9992	9.9999	1.0000	0.1000	0.0199	1/21	0952	PDG	56	72	34
Yes	No	139.9992	99.9993	9.9999	1.0000	0.1000	0.0199	1-22	0719	JRP	55	69	39
Yes	Yes	139.9991	99.9992	9.9999	1.0000	0.1000	0.0199	1/25	1345	PDG	55	69	39
Yes	No	139.9991	99.9992	9.9999	1.0000	0.1000	0.0199	1/27	1345	ATM	59	74	40
Yes	No	139.9993	99.9994	10.0000	1.0001	0.1001	0.0200	1/30	0600	ATM	58	70	48
Yes	No	139.9993	99.9993	10.0000	1.0000	0.1000	0.0199	1/30	1121	PDG	58	74	36
Yes	No	139.9993	99.9994	9.9999	1.0000	0.1000	0.0199	1/31	1550	ATM	59	74	40
Yes	No	139.9992	99.9993	10.0000	1.0000	0.1000	0.0199	2/1	1055	ATM	57	70	41
Yes	No	139.9992	99.9993	9.9999	1.0000	0.1000	0.0199	2/2	1755	ATM	57	71	41
Yes	Yes	139.9991	99.9992	9.9999	1.0000	0.1000	0.0200	2/3	0521	ATM	59	72	43
Yes	No	139.9991	99.9992	10.0000	1.0001	0.1000	0.0199	2/3	1913	ATM	56	68	46
Yes	Yes	139.9991	99.9992	9.9999	1.0001	0.1001	0.0199	2/4	0514	ATM	60	74	43
Yes	Yes	139.9992	99.9993	9.9999	1.0000	0.1000	0.0199	2/5	0547	ATM	59	74	40
Yes	Yes	139.9991	99.9992	9.9999	0.9999	0.1000	0.0199	2/5	1940	ATM	57	69	47
Yes	No	139.9992	99.9993	10.0000	1.0001	0.1001	0.0199	2/6	1925	ATM	57	70	41
Yes	No	139.9992	99.9993	10.0000	1.0001	0.1001	0.0200	2/7	0755	ATM	57	70	41
Yes	Yes	139.9992	99.9992	10.0000	1.0001	0.1001	0.0200	2/8	0810	ATM	56	71	37
Yes	Yes	139.9992	99.9992	9.9999	1.0000	0.1001	0.0200	2/8	2110	ATM	56	69	43
Yes	Yes*	134.9992	99.9992	9.9999	0.9999	0.1000	0.0199	2/9	1936	ATM	57	70	41
Yes	Yes	134.9992	99.9992	9.9999	1.0001	0.1001	0.0199	2/10	0530	ATM	54	66	44
Yes	No	134.9992	99.9992	10.0000	1.0001	0.1001	0.0199	2/10	1935	ATM	55	67	45
Yes	No	134.9992	99.9992	9.9999	1.0000	0.1000	0.0199	2/11	1553	ATM	56	69	43
Yes	No	134.9993	99.9993	9.9999	1.0001	0.1001	0.0199	2/12	1910	ATM	53	64	46
Yes	No	134.9992	99.9992	10.0000	1.0001	0.1000	0.0199	2/13	1745	ATM	55	66	48
Yes	No	134.9992	99.9992	10.0000	1.0000	0.1000	0.0199	2/14	1905	ATM	55	66	48
Yes	No	134.9992	99.9992	10.0000	1.0000	0.1001	0.0199	2/15	1502	ATM	57	69	47
Yes	Yes	134.9991	99.9992	10.0000	1.0000	0.1000	0.0200	2/16	1909	ATM	55	67	45
Yes	No	134.9994	99.9993	10.0000	1.0000	0.1000	0.0199	2/18	1935	ATM	58	70	48
Yes	No	134.9992	99.9992	9.9999	1.0001	0.1001	0.0199	2/19	1704	ATM	56	69	43
Yes	No	134.9992	99.9992	9.9999	1.0000	0.1001	0.0200	2/20	1305	ATM	54	68	38
Yes	No	134.9993	99.9994	9.9999	1.0001	0.1000	0.0199	2/21	1541	ATM	56	68	46

* Switched to 20 mg wt; weighing 100, 20, 10 & 5 together for 135.0000

Woodstove Data Sheet 4-4 Scale QC Record Sheet
Scale 2

From: 4/6/10
Through: 7/22/10

Scale: Sartorius
Model: CPA 2245
SN: 24850860
Rev: 5/10

* 135.0000 g + 100.0000 + 20.0000 + 10.0010 + 5.0000 2010

Level	Recali-brated	135g * Weights	100g Weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9998	99.9997	9.9999	1.0000	0.0999	0.0199	4/6	1601	ATM		60	75	40	
Yes	No	134.9994	99.9994	9.9999	1.0001	0.1001	0.0199	4/13	0945	ATM		57	70	44	
Yes	No	134.9996	99.9996	10.0000	1.0001	0.1001	0.0199	4/13	1338	ATM		60	72	48	
Yes	Yes	134.9993	99.9993	9.9998	0.9999	0.0999	0.0199	4/14	1445	JRP		59	71	48	
Yes	Yes	134.9994	99.9994	9.9998	0.9999	0.0999	0.0198	4/15	1048	PDG	28.43	58	72	42	
Yes	No	134.9996	99.9994	9.9999	1.0000	0.1000	0.0200	4/22	1455	ATM	28.13	62	75	47	
Yes	No	134.9996	99.9996	9.9999	1.0000	0.1000	0.0199	5/5	1100	ATM	28.43	61	75	44	117
Yes	No	134.9996	99.9995	9.9999	0.9999	0.1000	0.0199	5/7	1600	ATM		59	73	42	122
Yes	No	134.9996	99.9995	9.9999	1.0000	0.0999	0.0200	5/8	1140	ATM	28.28	59	71	48	120
Yes	No	134.9995	99.9994	9.9999	1.0000	0.1000	0.0199	5/11	1349	ATM	28.39	55	68	42	119
Yes	No	134.9995	99.9994	9.9999	0.9999	0.1000	0.0199	5/12	1311	ATM	28.34	60	73	46	120
Yes	No	134.9996	99.9995	9.9999	1.0000	0.1000	0.0199	5/13	1340	ATM	28.37	62	75	47	119
Yes	No	134.9996	99.9995	10.0000	1.0001	0.1001	0.0200	5/14	0630	ATM	28.31	58	71	44	120
Yes	Yes	134.9996	99.9994	9.9998	0.9999	0.1000	0.0199	6/2	1602	ATM	28.09	61	75	46	118
Yes	No	134.9996	99.9995	9.9999	1.0000	0.1000	0.0199	6/22	2041	ATM	28.45	58	70	48	121
Yes	Yes	134.9995	99.9994	9.9999	1.0006	0.1000	0.0199	6/27	1710	ATM	28.29	60	74	43	117
Yes	No	134.9994	99.9994	9.9999	1.0000	0.1000	0.0199	6/29/10	1407	ATM	28.20	61	74	47	119
Yes	No	134.9993	99.9993	9.9998	1.0000	0.1000	0.0198	7/14/10	1640	PDG	28.41	62	75	49	118
Yes	No	134.9997	99.9996	9.9999	1.0000	0.1000	0.0199	7/15/10	1128	ATM	28.43	60	73	46	118
Yes	No	134.9996	99.9995	9.9999	1.0000	0.1000	0.0199	7/16/10	1810	ATM	28.28	61	75	44	117
Yes	No	134.9997	99.9996	9.9999	0.9999	0.0999	0.0199	7/17/10	1800	ATM	28.29	60	73	46	120
Yes	No	134.9996	99.9994	9.9999	1.0000	0.0999	0.0199	7/18/10	2015	ATM	28.25	61	74	47	120
Yes	No	134.9996	99.9995	9.9999	0.9999	0.1000	0.0199	7/19/10	1040	ATM	28.40	60	73	46	119
Yes	No	134.9996	99.9994	10.0000	1.0000	0.1000	0.0199	7/20/10	1810	ATM	28.36	62	75	47	118
Yes	No	134.9996	99.9995	9.9999	0.9999	0.0999	0.0199	7/20/10	1350	ATM	28.36	59	72	45	118
Yes	Yes	134.9995	99.9994	9.9999	1.0001	0.1001	0.0199	7/21/10	1715	ATM	28.22	63	77	45	117
Yes	No	134.9996	99.9994	9.9999	0.9999	0.0999	0.0199	7/22/10	1617	ATM	28.16	61	74	46	119
Yes	Yes	134.9994	99.9994	9.9999	0.9999	0.0999	0.0199	7/26/10	2141	ATM	28.15	62	76	45	120

Woodstove Data Sheet 4-4 Scale QC Record Sheet

Scale 2

From: 7/27/10
Through: _____

Scale: Sartorius
Model: CPA 2245
SN: 24850860
Rev: 5/10

2010

Level	Recalibrated	135g Weights	100g Weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9996	99.9995	9.9999	1.0000	0.1000	0.0200	7/27/10	2206	ATM	28.32	63	76	49	110
Yes	Yes	134.9994	99.9994	9.9999	0.9999	0.1000	0.0199	7/28/10	1340	ATM	28.34	64	77	49	116
Yes	No	134.9996	99.9996	9.9999	1.0000	0.1000	0.0199	7/29	1330	ATM	28.41	64	77	49	115
Yes	NO	134.9995	99.9995	9.9999	1.0000	0.0999	0.0199	7/30	1639	ATM	28.25	64	77	49	116
Yes	No	134.9994	99.9994	9.9999	0.9999	0.0999	0.0199	7/31	1020	ATM	28.29	58	72	42	116
Yes	No	134.9995	99.9994	9.9999	1.0000	0.1000	0.0199	7/31	2005	ATM	28.22	64	77	49	119
Yes	No	134.9996	99.9994	9.9999	0.9999	0.0999	0.0199	8/1	0926	ATM	28.32	56	68	46	116
Yes	NO	134.9996	99.9994	9.9999	1.0000	0.1000	0.0199	8/1	2050	ATM	28.30	61	74	47	117
Yes	Yes	134.9995	99.9994	9.9999	0.9999	0.0999	0.0199	8/2	0759	ATM	28.40	58	70	48	117
yes	no	134.9994	99.9994	9.9999	1.0000	0.1000	0.0199	8/2	12:50	SEK	28.37	61	75	46	118
Yes	NO	134.9994	99.9994	9.9999	0.9999	0.1000	0.0199	8/3	1600	JRP	28.34	58	70	48	116
yes	no	134.9996	99.9995	9.9999	1.0000	0.1000	0.0199	8/4	10:20	SEK	28.43	54	66	44	118
Yes	NO	134.9994	99.9994	9.9999	1.0000	0.0999	0.0199	8/5	1000	JRP	28.33	56	67	49	119
yes	NO	134.9996	99.9994	10.0000	1.0000	0.1001	0.0199	8/6	11:24	SEK	28.21	58	72	41	119
Yes	YES	134.9995	99.9995	9.9999	0.9999	0.0999	0.0199	8/8	1446	JRP	28.21	60	73	46	118
yes	NO	134.9995	99.9994	9.9999	0.9999	0.1000	0.0199	8/12	10:43	SEK	28.18	56	68	46	117
Yes	NO	134.9994	99.9995	9.9999	0.9999	0.0999	0.0199	8/14	1457	JRP	28.47	58	70	48	116
Yes	No	134.9995	99.9995	9.9999	1.0000	0.1000	0.0199	8/16	0743	ATM	28.41	56	68	46	119

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

Unit: Kuma U.3
Run: EPA 3
Date: 7/16/10
Technicians: ATM
Revised 12/09-Data Sheet #5

Filters

Filter # (front) 119 | **Beaker #** 34 | **Final Wt.** 53.2668 g
Final Wt. .6731 g | **Ml** 55 | **Tare Wt.** 53,2620 g
Tare Wt. .6562 g | **Desc.** Acetone | **Net Wt.** .0048 g
Net Wt. .0169 g +

Filter #(Rear) 118 | **Beaker #** _____ | **Final Wt.** _____ g
Final Wt. .6567 g | **Ml** _____ | **Tare Wt.** _____ g
Tare Wt. .6564 g | **Desc.** _____ | **Net Wt.** _____ g
Net Wt. .0003 g +

Acetone Blank Calculation: **Blank Date:** 7/13/10

Blank Beaker # 29 | **Final Wt.** 71.5194 g
Ml 50 | **Tare Wt.** 71.5193 g
Desc. Acetone | **Net Wt.** .0001 g

.0001 g/ 50 ml = .000002 g/ml

Blank Residue Value Calculation:

.000002 g/ml acetone X 55 ml acetone = .00011 g
Blank Residue Value

Total Particulate Catch Calculation:

Filter: .0169 g
Filter: .0003 g
Beakers: .0048 g - .00011 g = .00469 g
Total Catch **Blank Residue Value**

Total Catch = .02189 g
21.89 mg

Unit: Hawk V.3
Run # EPA 3
Date: 7/16/10
Technician: AM POG JRP
WST6-Form1, Rev 5/10

Miscellaneous Test Data
Woodstove Data Sheet #8

Useable Firebox Dimensions: See QC Section Useable Volume: 1.554 ft³

Dilution Tunnel Draft (If Applicable): Start: 0.000 Stop: 0.000 Avg: 0.000 in. H_2O

Test Chamber Air Velocity: 10 Start: 12 Stop: _____ Avg: 11 ft./m.

Wet Bulb/ Start: WB: 63 °F DB: 80 °F % Amb Moisture: 1.35 %RH: 38

Dry Bulb Stop: WB: 65 °F DB: 82 °F % Amb Moisture: 1.50 %RH: 39

X Ambient Moisture(%Vol.) = 1.425 % X Relative Humidty (%RH) = 38.5 %

Empty Stove Wt: 329.1 lbs. 543.7

Empty Stove Wt with Stack (inc oil seal) Wet: 542.9 lbs. Dry: 543.2 lbs.

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

Kindling Wt. Paper: 0.2 lbs. Wood: 4.8 lbs. Total: 5.0 lbs.

Pre Burn Fuel Wt. 8.528 + 8.604 + 8.880 Total: 26.012 lbs.

Total Kindling and Pre Burn Fuel Wt. 31.012 lbs.

Coal Bed Wt-lbs: Range(2.4 - 2.0) 545.6 - 545.2 lbs. Actual: 2.0 lbs. 545.2

Allowable Amount of Charcoal That Can Be Removed:

Coal Bed Wt. Range (2.4 (Upper Wt.) + 2.0 (Lower Wt.) /2) .25 = 0.5 lbs.

Test Fuel Wt-lbs: Ideal 10.9 lbs. Range: 11.9 - 9.8 lbs. Actual: 9.820 lbs.

Test Fuel Size (pcs.) (.75 x 1.5 x 5" Flanges): 14 Pcs. 1.498 lbs.

2 x 4's x 14 1/8 " 3 Pcs. 6.124 lbs. 62.36 %

4 x 4's x 14 1/8 " 1 Pcs. 3.696 lbs. 37.64 %

3.7128 kg

Est. Dry Burn Rate(Kg/Hr.) 9.820 - (9.820 x .16648) X 60 = 1.2376
2.2046 100 Dry Burn Rate (Kg/Hr)

Est EPA Heat Output (HO_E)(Avg BTU's/Hr) (19,140) X 63 x 1.2376 = 14,923
100 EPA Heat Output (HO_E)BTU's/Hr

120 mins = 1.8564 kg/hr.
180 mins = 1.2376 kg/hr
225 mins = 0.9901 "

Stove Operating Data
Woodstove Test Data Sheet #9
Cold Start

Fire Started: 0900 PDST

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 1.875" . At the run setting until start of the test. 3.216" on Rod

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 bet. In stove for 38 seconds.

Test: Door wide open during loading 1 min 17 sec, then closed.

Primary Air: Wide open from the start of the test (0:00) until 4:30. Adjusted to the run setting of 1.875" open between 4:30 and 4:45. At the run setting of 1.875" open at 5:00 into the run.
shut PAC down early because fire really took off.

Secondary Air: No Controls, Naturally drafted

Secondary Burn/[redacted] Bypass: N/A

Fan: ON (OFF) during the warm up, (ON) / OFF Low during the preburn, ON (OFF) at the start of the test, ON (OFF) for the first 30 minutes of the test, (ON) / OFF Low at 30:00 minutes into the test (ON) / OFF for the rest of the test.

Test Run Anomalies:

Unit Kuma V.3
Run # EPA 3
Date 7/16/10
Technician _____

WST7-Form2-A, Rev 12/09

Woodstove Operating Data
Woodstove Data Sheet # 9A-1

Wood Data: Kindling: A mix of the below grades

	Size	Mill	Grade	Species
Pre Burn	2X4	Manke Tacoma	STD & BTR #2	D. Fir Std Grn
Test Fuel	2X4	Manke Tacoma	#2, STD & BTR	D. Fir Std Grn
	4X4	Forrest Grove	#1, STD & BTR	D. Fir Std Grn

All grades WCLB Rules Unless otherwise noted

Warm Up Information:
1st Warm Up/Pre Burn Fuel Charge (8.528 lbs) added at 09:24.
2nd Warm Up Pre Burn Fuel Charge (8.604 lbs) added at 10:17.
3rd Warm Up/Pre Burn Fuel Charge (8.880 lbs) added at 11:13.
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 _____.

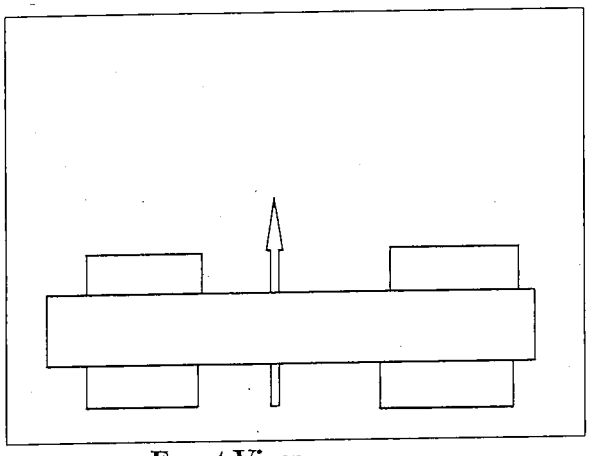
The coals were scooped out of the stove immediately prior to adding the 3rd pre burn/warm up fuel charge. The stove ~~lost~~ gained 0.3 lbs. 1.5 lbs of hot coals were put back in the stove.

All pre burn/warm up fuel pieces were ~~either~~ _____ ~~or~~ 12 inches long. All pre burn pieces/fuel charges were "ricked" in the stove. The pieces in the bottom layer in each rick contained 2 pieces that were 12" 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 pieces 12" inches long. The third layer (and fourth layer if present) was loaded flat, perpendicular to the door and contained 2 pieces 12 inches long. The majority of the pieces in each rick were in the second layer. (The loading directions indicate the direction of the longest dimension on each piece relative to the loading door opening.)

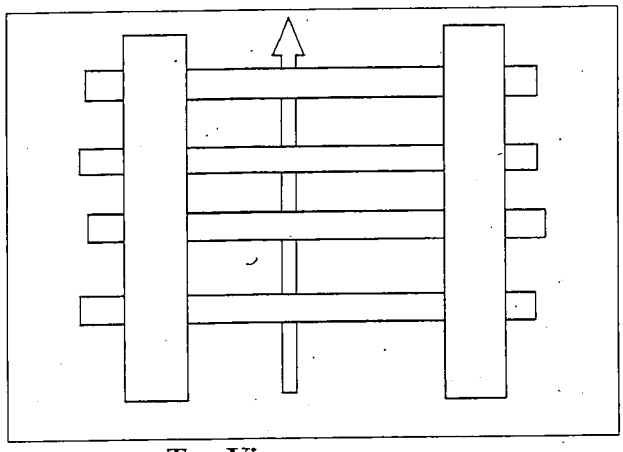
Wood Stove Operating Data
Wood Stove Data Sheet #9A-2

Warm Up Information (cont.):

Each warm up/preburn fuel charge was ricked in exactly (as much as possible) the same manner. The physical arrangement and alignment of the pieces in 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 collapsed or fallen down state) until 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 hot as quickly as possible during the warm up period, thereby maximizing the amount of heat (BTU's) stored in the stove. For this stove, the thermal storage was monitored using the Top (#4) surface temperature (s) and the peak value (s) obtained were 1097 °F 1031 1097



Front View



Top View

The arrows indicate the direction of the air flow through the rick. Note: The top and bottom layers may be offset

(Rod extension 3.216")

The primary air was adjusted to the run setting of 1.875" 35 lbs above the upper charcoal bed weight.

Unit: Kuma V3
Run #: EPA 3
Date: 7/16/10
Technician: AJM JRP PDG
Page 3 of 4
WST5-Form2, Rev 12/09

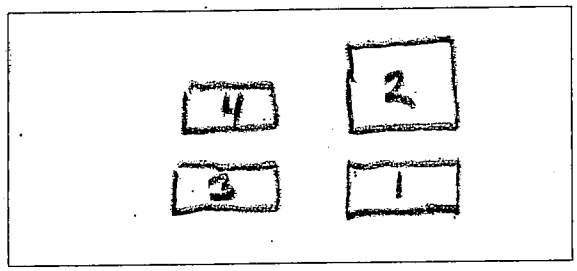
Woodstove Operating Data
Woodstove Data Sheet #9A-3

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

Total Elapsed Time: 1117
Photo Taken @: 2116

Test Fuel Charge Loading Information:

Test Fuel Charge and Loading Sequence Diagram



END of Stove View
4 X 4's: R
2 X 4's: 1, 3, 4
Loading Sequence: 1, 2, 3, 4
Driest Pcs in Load 1, 3

Loaded the test fuel charge on an essentially level, small sized, avg to hot coal bed (in appearance, color and temperature) for a M. high burn rate.

(1) Ignition: N 0145 (2) Loaded stove and closed door 1117 (3) VC+baffle @ N 1:20 2116 Photo
2134 3.17/.3+ Med Light smoke Ore Balance
2154 Secondaries forward past front tube on left and right sides of fuel load.
3124 Front Tube ignighting
4130 - 4145 PAC adjusted to the rum setting
5100 Maintained a hot porchet of coals under 5

Unit Kuma V.3
Run # EPA 3
Date 7/16/10
Technician AMyren
Page 4 of 4
WST5-Form2-Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-4

Additional Comments:

with a VC up to baffle. VC especially off pc 3
Also had secondaries above pcs 2 & 4,
" " a VC on the left side of the fuel load.

5:45 12.60/1.56 Wispy
9:30 Secondaries down right side of 2 (4x4) but most forward over the top of 2
12:32 14.85/1.03 Light, Stoolerts.

Unit: Kuma V.3
Run: EPA 3
Date: 7/16/10
Technician: ATM

WST1-Form7-Rev 7/10

Fuel Moisture
Woodstove Test Data Sheet # 10

Room Temperature: 65.6 °F Correction Factor: .44 Ohaus Ranger

Note: Record readings to the nearest 0.1% moisture Scale Check

Uncor Values are corrected for temperature: Yes ____. No ✓ 0.000lb.: 0.000

Time Test Fuel Moisture Readings Taken at: 10:09 1.0 kg = 2.204

Moisture Meter: Delmhorst Model: J-2000 SN: 34284 5.0 kg = 11.024

Calibration Checks: 12.0 12.0 MCS-1: 12.7 12.8 23.6 23.8

PC #	Dimen	Use	Top	Bottom	Side	Piece Avg	± Temp Cor.	Piece Avg Corrected	
1	3 pcs.	K	8.7	9.5	9.4	9.2	+.44	9.640	
2									
3	2X4-8'	P	21.3	19.8	21.4	20.833	+.44	21.273	
4	"	"	22.6	19.5	20.9	21.000	"	21.440	
5	"	"	22.0	18.8	21.9	20.900	"	21.340	
6	↓	↓	23.8	22.0	21.7	22.500	↓	22.940	
7								86.993	
8									
9									
10	2X4-14 1/8"	T	17.7	19.2	20.0	18.967	+.44	19.407	1.346
11	"	"	17.2	21	21.3	19.833	"	20.273	1.818
12	"	↓	18.4	19.2	20.1	19.233	↓	19.673	1.728
13									
14									
15	4X4-14 1/8"	T	16.6	18.9	24.8	20.100	+.44	20.540	3.1480
16								79.893	
17	5X1.5X.75	T	22.1	19.9	20.1	20.700	+.44	21.140	1.498
18	(Spacers)						OUT	Spacers	
19									
20									

	Kindling	Pretest Fuel	Test Load
% Moisture – Dry Basis:	9.640 %	21.74825 %	19.97325 %
% Moisture – Wet Basis:	8.792 %	17.863 %	16.648 %

To obtain Wet from Dry: 100 X % Dry Rdg. / 100 + % Dry Rdg. = % Moisture, Wet Basis

Acceptable Ranges: 16-20% wet; 19-25% dry

Key For Use: K= Kindling P= Pretest Fuel T= Test fuel

3.7128 kg 9.820 3.696

1. 8.528 lbs 7 pcs
2. 8.604 "
3. 8.880 "

WOODSTOVE TEST DATA SHEET #11 Technician: [illegible]

WST2-form11-Rev 6/90

Wood Piece: Nominal Dimensions: 2X4 — 3.375" x 3.5" x 1.5"

Depth (D): 3.875 cm

Width (W): 8.895 cm

Length (L): 8.885 cm
8.620 cm
8.630 cm
8.640 cm

Length $\bar{X}$ = 8.66875 cm

Volume: 298.796 cm^3 (D X W X L) 4

MOISTURE: Room Temperature: 65.6 °F Correction Factor: +0.44

Uncorrected Meter Readings Corrected for temperature: Yes ___ No ✓

NOTE: Record moisture meter readings to the nearest 0.5%

	Uncor	Cor
Top:	16.7	16.7 %
Bottom:	16.2	16.2 %
Side:	6.5	6.8 %
$\bar{X}$:		13.233 % +0.44

Avg % Moisture (Dry) 13.673 %

Aug % Moisture (Wet) 12.029 %

Scale: Leveled In ✓ Out ✓

Zeroed: In ___ Out ___

Wet Weight: 182.0 g Dry Weight: 159.7 g

% Moisture Dried Basis: 12.253 %
[1 - (Dry Wt ÷ Wet Wt)] X 100

	Date	Time	Temp
Into Dryer	7/16/10	2022	180 °F
Out of Dryer	7/29/10	1123	202 °F

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

Density = 174.3 g (dry wt) ÷ 298.796 cm^3 (volume) = 0.5833 g/cm^3

Pellet Fuel Moisture Content Determination

Tare Beaker Wt. ___ g

Wet Wt: ___ g (Gross Wet Wt.) - ___ g (Tare Beaker Wt.) = ___ g (Net Wet Wt.)

Dry Wt: ___ g (Gross Dry Wt.) - ___ g (Tare Beaker Wt.) = ___ g (Net Dry Wt.)

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

2 - 174.6

Pre Burn Data
Record Sheet #13

Unit: Kuma V.3 Date: 7/16/10
Run: EPA 3 Technician(s): ATM JZP PDG
Page: 1 of 1 WST2-Form 16, Rev 12/09

reburn Start Wt. 549.1 Lbs. Up 3.5 lbs.
'est Start Wt Range 545.6 - 545.2 lbs.
Baro. Pressure 28.20 "Hg

Hot Box On 13 ✓ 17 L

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 [redacted]	11 Room Temp	Static		Comments 3.216" on Rod
1127	549.1	0.0	503	1055	637	579	628	461	1113	1580	79	-.080		Primary Air Set At 1 7/8"
32	548.2	.9	505	1025	647	563	637	442	1126	1577	79	-.076		Secondary Air Set At Fixed
37	547.3	.9	481	992	658	560	648	434	1132	1583	79	-.073		Fan: On Low ✓ 1730 RPM
42	546.7	.6	461	974	670	569	661	438	1185	1541	81	-.070		Tunnel on at: 21 min
47	546.4	.3	425	922	676	579	669	436	1229	1481	81	-.064		Buckets Iced ✓
52	546.2	.2	379	826	680	592	673	433	1198	1341	80	-.060		Analyzers Spanned ✓
57	546.0	.2	366	776	679	594	672	432	1164	1288	80	-.055		Pumps Turned on at: 46 min
1202	545.9	.1	350	730	674	593	667	425	1116	1230	81	-.053		617.8 ΔT — ΔΔT
07	545.7	.2	336	689	665	585	658	425	1085	1185	81	-.057		604.4 -13.4
12	545.6	.1	328	659	656	567	647	422	1013	1124	81	-.050		590.2 -14.2
17	545.5	.1	317	633	644	546	632	416	985	1083	81	-.049		574.2 -16.0
22	545.4	.1	311	616	636	535	621	407	965	1084	81	-.046		Tunnel ΔP 563.0 -11.2
													X	Probe In Tunnel
1227	545.3	.1	303	595	623	518	607	406	936	1009	80	-.046		549.8 -13.2
32	545.2	.1	300	581	612	504	595	404	925	994	82	-.045		539.2 -10.6
70														
75														
80														
85														
90														
95														
100														
105														
110														
115														

Myren Cr ...lting Inc Data Sheet P1 of 4 Unit Kuma V.3 Date 7/16/10 Run ET-1 3

Test End ..5545.2 ΔT 539.2 Barometric Pressure 28.26 ...g Gas Flows @ 1.5" Technician(s) ATM JRP [illegible] CSO

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	Stack Temp #3	Stack Static Press
0	1232	555.0	9.8	0	.281	6.99		13.24	.133	1.33	5.3	F	ML	FAN OFF	300	-.045
05	37	554.4	9.2	.6	.215	5.37		15.11	.084	.84	6.4		wisps	Bal 6:00 N	458	-.056
10	42	553.7	8.5	.7	.455	11.28		9.35	.054	.54	20.9	Bal	L		412	-.066
15	47	552.8	7.6	.9	.69	14.88		5.21	.162	1.62	9.2	O/B	L ⇄ ML		453	-.070
20	52	552.0	6.8	.8	.630	15.60		4.47	.167	1.67	9.3		ML		459	-.070
25	57	551.2	6.0	.8	.636	15.75		4.37	.156	1.56	10.1	B	"	Stacking is	457	-.070
30	1302	550.4	5.2	.8	.647	16.02		4.12	.152	1.52	10.5	F	"	FAN ON	456	-.069
35	07	549.7	4.5	.7	.630	15.60		4.47	.166	1.66	9.4	O/B	ML → L		444	-.066
40	12	549.2	4.0	.5	.592	14.66		5.75	.097	.97	15.1	B	L		432	-.065
45	17	548.9	3.7	.3	.519	12.86		7.84	.040	.40	32.2		wisps		406	-.061
50	22	548.5	3.3	.4	.488	12.10		8.55	.050	.50	24.2		Clear		393	-.060
55	27	548.1	2.9	.4	.497	12.32		8.48	.019	.19	64.8		"		383	-.058
Total															5053	.756

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 #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	M56-2 Box 17	M56-2 Temp 18
0	1232	581	612	504	595	404	925	994	82	104	210	36	67	55	229	35
05	37	592	588	473	570	456	865	1192	81	125	202	36	73	37	241	35
10	42	694	575	441	552	462	742	1278	81	117	211	38	78	37	222	36
15	47	817	566	411	533	465	787	1307	81	117	224	37	81	37	213	36
20	52	852	570	402	527	465	821	1313	82	118	232	37	83	37	227	37
25	57	882	582	400	531	465	861	1364	82	119	234	37	84	37	239	37
30	1302	897	592	402	536	466	883	1401	83	119	231	37	83	37	233	37
35	07	905	613	402	550	448	925	1449	83	119	223	37	83	37	223	37
40	12	898	626	408	559	439	942	1443	84	118	217	37	83	37	222	37
45	17	842	643	420	569	432	962	1431	84	117	218	37	83	37	227	37
50	22	809	651	429	574	428	958	1377	86	116	221	37	84	37	231	38
55	27	780	656	440	577	426	994	1388	83	115	220	38	84	37	230	37
Total		9549	7274	5132	6673	5356	10605	15937	992							

Myren C[illegible]ulting Inc Data Sheet P2 of 4 Unit KUMA V.3 Date 2/16/10 Run EPA 3

Test End Wt. 545.2 ΔT 539.2 Barometric Pressure 28.27 "hg Gas Flows @ 1.5" Technician(s) ATM JRP PAG

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	1332	547.8	2.6	.3	.497	12.32		8.48	.020	.20	61.6	clear				378	-.056
65	37	547.5	2.3	.3	.478	11.85		8.96	.017	.17	69.7	"				367	-.055
70	42	547.3	2.1	.2	.425	10.54		10.25	.021	.21	50.2	"				357	-.054
75	47	547.0	1.8	.3	.441	10.94		9.85	.023	.23	47.6	" end of 4x4 down on	LPAO	Blocking		349	-.053
80	52	546.8	1.6	.2	.365	9.07		11.67	.032	.32	28.3	"				339	-.051
85	57	546.7	1.5	.1	.307	7.64		12.90	.072	.72	10.6	"				319	-.049
90	1402	546.6	1.4	.1	.253	6.30		14.00	.120	1.20	(5.3)	"				307	-.046
95	07	546.5	1.3	.1	.258	6.43		13.90	.114	1.14	5.6	"				294	-.045
100	12	546.4	1.2	.1	.247	6.16		14.11	.127	1.27	4.8	"				290	-.044
105	17	546.3	1.1	.1	.232	5.79		14.43	.136	1.36	4.3	"				280	-.043
110	22	546.3	1.1	0	.223	5.56		14.70	.128	1.28	4.3					276	-.041
115	27	546.2	1.0	.1	.218	5.44		14.77	.137	1.37	4.10					269	-.040
Tot																(3825)	(.577)

M56-2

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	~~Tube 1~~ Box #17	~~Tube 2~~ Rocket #18	Tube 3 #19	H_2O H box #20
60	1332	769	658	449	580	424	1028	1328	84	114	219	38	85	38	229	38		
65	37	748	656	461	586	423	1022	1250	84	113	218	37	84	37	228	38		
70	42	727	653	469	592	424	1016	1235	84	112	217	38	85	37	231	38		
75	47	713	644	472	596	425	1031	1241	83	111	218	38	85	37	232	38		
80	52	689	639	471	598	425	985	1193	84	111	218	38	85	37	232	38		
85	57	642	627	469	593	421	921	1097	83	111	218	37	85	37	231	38		
90	1402	614	618	468	584	428	878	996	85	110	216	37	85	37	231	38		
95	07	579	604	465	569	428	852	941	84	108	216	37	85	37	232	38		
100	12	564	596	465	559	426	831	917	85	108	217	38	86	37	231	38		
105	17	535	581	462	543	422	802	885	83	107	218	37	85	37	231	38		
110	22	526	574	460	534	418	786	874	84	107	220	38	85	37	231	38		
115	27	507	562	459	522	414	766	856	83	105	221	37	85	37	231	38		
Tot		(7613)	(7412)	(5570)	(6856)	(5078)	(10918)	(12813)	(1006)									

Myren C ulting Inc Data Sheet P3 of 4 Unit Kuma : V 3 Date 7 / 16 / 10 Run EPA 3

Test End rt. 545.2 ΔT 539.2 Barometric Pressure 28.24 "hg Gas Flows @ 1.5" Technician(s) ATM JRP D

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	1432	546.1	.9	.1	.215	5.37		14.84	.138	1.38	3.9					267	-.040
125	37	546.0	.8	.1	.205	5.12		15.08	.140	1.40	3.7					261	-.039
130	42	546.0	.8	0	.201	5.02		15.17	.142	1.42	3.5					257	-.039
135	47	545.9	.7	.1	.197	4.92		15.22	.151	1.51	3.3					254	-.039
140	52	545.8	.6	.1	.204	5.10		15.06	.148	1.48	3.4					252	-.039
145	57	545.7	.5	.1	.207	5.17		14.99	.147	1.47	3.5					249	-.036
150	1502	545.7	.5	0	.214	5.33		14.97	.118	1.18	4.5					248	-.036
155	07	545.6	.4	.1	.226	5.64		14.67	.118	1.18	4.8					246	-.036
160	12	545.5	.3	.1	.219	5.47		14.79	.128	1.28	4.3					245	-.036
165	17	545.4	.2	.1	.28	5.44		14.84	.123	1.23	4.4					243	-.035
170	22	545.4	.2	0	.217	5.42		14.87	.122	1.22	4.4					241	-.035
175	27	545.3	.1	.1	.214	5.34		14.94	.123	1.23	4.3					239	-.035
Tot																3002	-.445

M5 6-2

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	Box #17	Bucket #18	Tube 2 #19	Tube 3 #20
120	1442	497	554	458	513	410	755	843	83	105	222	37	85	37	231	38		
125	37	482	543	456	501	403	748	822	84	105	223	37	85	37	231	39		
130	42	472	534	454	492	398	736	804	84	104	223	38	85	38	231	39		
135	47	459	523	451	482	392	724	791	83	103	222	37	85	37	230	39		
140	52	454	518	450	476	388	720	792	83	103	221	38	86	38	231	39		
145	57	446	509	450	468	382	717	794	84	103	221	38	86	38	232	39		
150	1502	442	503	449	463	375	724	798	85	103	220	38	86	38	233	39	ΔT	ΔΔT
155	07	437	495	454	459	370	729	793	85	103	219	37	87	38	234	39	443.0	-96.2
160	12	433	491	454	457	367	726	788	85	103	218	38	88	38	235	39		
165	17	428	486	452	454	365	721	778	85	103	218	38	88	38	235	39		
170	22	425	482	450	451	363	710	775	85	104	219	38	89	38	235	39	434.2	-105.0
175	27	421	477	447	448	361	701	768	85	102	220	38	89	38	235	39		
Tot		5396	6115	5425	5664	4574	8711	9546	1011									

Myren Consulting Inc Data Sheet P4 of 4 Unit Kuma V.3 Date 7/16/10 Run PA3
Test E Yt 545.2 ΔT 539.2 Barometric Pressure 28.2 "hg Gas Flows @ 1.5" Technician(s) ATM JRI CSO

Time E/T min		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	1532	545.2	0	-1	.217	5.42	[illegible]	[illegible]	125	125						238	-.035
185																238	-.035
190												Total				12118	-6.813
195												Total				328	-.049
200												Avg ÷ 37					
205																	
210																	
215																	
220																	
225																	
230																	
235																	
Tot																	

M56-2

Time E/t		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~~ Box #17	~~Tube 1~~ Budcat #18	~~Tube 2~~ ΔT #19	~~Tube 3~~ ΔΔT #20
180	1532	419	474	445	445	358	699	766	84	102	222	38	90	38	234	39	428.2	-111.0
185		(419)	(474)	(445)	(445)	(358)	(699)	(766)	(84)	Total								
190		(229774)	(21275)	(16572)	(19638)	(15366)	(30993)	(39062)	(3093)	Total								
195		(621)	(575)	(448)	(531)	(415)	(838)	(1056)	(84)	Avg ÷ 37								
200															Delta T			
205															Start	539.2		
210															Stop	428.2		
215															ΔΔT	-111.0		
220																		
225																		
230																		
235																		
Tot																		

Pre and Post Test Zero/Span Check
Woodstove Data Sheet #15-1

Site: Myren Consulting, Colville, WA Date: 7/16/10 Analyte: CO_2

Source: Kuma V.3 Run #: FPA 3

Zero Cyl #: AA-9167 Conc. 00.0 % CO_2 Cyl Press: 2070 psi

Certified By: Oxarc Date: 5/11/09

Span Cyl #: SX-45410 Conc. 12.6 % CO_2 Cyl Press: 1610 psi

Certified By: Mathesom Tri Gas Date: 4/12/10

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 Values= 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: 1143 Temp: 76 °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	.0666	+0.0666	+0.27
Span	50.0	.500	12.5	49.75	.500	12.394	−0.2060	−1.65

Comments:

Post Run Audit: By: A.T. Myren Time: 1627 Temp: 86.0 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	00.0	.002	.1159	+0.1159	+0.46
Span	50.0	.500	12.5	50.5	.504	12.4926	−0.1074	−0.85

Comments:

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

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

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

Pre and Post Test Zero/Span Check
Woodstove Data Sheet # 15-3

Site: Myren Consulting, Colville, WA Date: 7/16/10 Analyte: CO

Source: Kuma V.3 Run #: 3

Zero Cyl #: AA-9167 Conc. 00.0 % CO Cyl Press: 2070 psi

Certified By: Oxarc Date: 5/11/09

Span Cyl #: SY-45410 Conc. 2.55 % CO Cyl Press: 1610 psi

Certified By: Matheson T.C. Gas Date: 4/12/10

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

Range: 0 - 10.0% CO (0 – 5.0% CO) Analyzer Output: 0 – 1.0 v.

Flow: 1.5 SCFH Measured By: Rotameter: X Flowmeter: _____

EPA Span Values= 5.0% CO

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

Pre Run Audit: By: A.T. Myren Time: 1143 Temp: 76 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	0.00	.001	.01694	+0.01694	+0.34
Span	2.55	.255	2.55	2.56	.256	2.5101	-0.03986	-1.56

Comments:

Post Run Audit: By: A.T. Myren Time: 1627 Temp: 86.0 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	0.01	.001	.01694	+0.01694	+0.34
Span	2.55	.255	2.55	2.46	.249	2.4417	-0.1083	-4.25

Comments:

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

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

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

Unit: Kuma V.3
Run: EPA 3
Date: 7/16/10
Technicians: ATM JRB PDG
WST6-Form3, Rev 12/09

Quality Checks
Woodstove Data Sheet #16

Ambient = Tr: _____ °F T/C # 30: —

Thermocouple Check (at ambient): T/C # 1: — °F; T/C#2: 67.4 °F
T/C # 3: 68.3 °F; T/C # 4: 69.4 °F; T/C #5: 70.5 °F;
T/C # 6: 70.2 °F; T/C # 7: 70.6 °F; T/C # 8: 70.3 °F;
T/C # 9: 71.7 °F; T/C # 10: 68.6 °F; T/C # 11: 64.4 °F;
T/C # 12: 66.6 °F; T/C # 13: 68.7 °F; T/C # 14: 65.4 °F;
T/C # 15: 65.2 °F; T/C # 16: 67.6 °F; T/C # 17: 65.6 °F;
T/C # 18: 65.2 °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	Adj	Post Test Check	%Difference
(0°F): -0.1 °F	to: — °F	Zero (0°F): 1.3 °F	+0.28
Span	Adj	Span	
(2000°F): 2000.7 °F	to: — °F	(2000°F): 2003.7 °F	+0.14

(Allowable % Difference = 1.5%. Use Formulas on Woodstove Data Sheet #15 to calculate % Difference, % Difference calculated in degrees absolute.)

Thermocouple Readout Pretest Linearity Check

0°F = 0.2 °F; 200°F = 202.0 °F; 400°F = 399.4 °F
600°F = 601.7 °F; 800°F = 802.0 °F; 1000°F = 1001.2 °F
1200°F = 1199.9 °F; 1400°F = 1400.0 °F; 1600°F = 1600.6 °F
1800°F = 1800.8 °F; 2000°F = 2000.8 °F

Combustion Gas (CO_2, O_2, CO) Train Leak Check: Pre OK ✓ PDG Post Ok ICSO
Draft (Static) Guage Zero Check: Pre OK ✓ JRB Post Ok ATM
Scale Check Pre (Wt, #'s): 547.4 - 542.4 = 5.0 lbs / 5.0 lbs = OK JRB
Post (Wt, #'s): 550.1 - 545.1 = 5.0 lbs / 5.0 lbs = Ok ATM

Stack Cleaned Prior to the Run: Yes_____ No_____
Tunnel Cleaned Prior to the Run: Yes_____ No ✓

EPA 4 10 M HI

DILUTION TUNNEL CALCULATIONS

MYREN CONSULTING CERTIFICATION TEST DATA

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

	6" Tunnel
File Name:	EPA 4
Manufacturer:	KUMA
Model Number:	V.3
Lab Name:	MYREN
Test Date:	7\19\10
Run Number:	EPA 4
Meter Box Y Factor:	1.0159
Barometric pressure (in):	28.3275
Gas meter temp (ave):	**89**
delta H(avg):	**0.900**
Gas meter initial reading:	896.4010
Gas meter final reading:	980.4860
Front catch (acetone) mg:	2.7
first filter catch (mg):	14.6
second filter catch (mg):	1.4
Tunnel Flow (Qsd) (dscfm)	**147.515**
Emission Rate(g/hr):	**2.125**
Emission Rate(M5H) :	**3.402**
Avg. of Delta P Sq. Roots:	**0.2091**
Vs (Avg.)(ft/min):	**889.555**
Tunnel Avg. Temperature (F):	**107.824**
Test time(min):	160
Fuel Load(lb. wet):	9.846
Wood moisture(%wet):	16.845
Burn rate(dry kg/hr):	**1.393**
Sample Volume (dscf)	**77.899**
Avg. Tunnel Static (-inch H2O):	**0.1724**
Room Blank Catch (mg/dscf):	0
Emission Factor (g/kg):	**1.5256**
Pitot Correction Factor:	0.97887
front filter number	123
back filter number	122
Beaker Number:	41
PRELIMINARY RESULTS	
FINAL RESULTS:	AUDITED

DATA SUMMARY

MODEL:	V.3
RUN:	EPA 4
DATE:	7\19\10
DBR:	1.393
EMISSION RATE (g/hr)(M5H)	3.4020
EMISSION FACTOR (g/kg):	1.5256
AVG. % PROPORTIONALITY :	99.596

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	0.042	99	896.4010	72	0.900	865.25			0.164	0.2049	
10	0.041	114	901.6140	74	0.900	866.29	108.9	4.967	0.169	0.2025	
20	0.044	117	906.7880	78	0.900	899.77	103.1	4.893	0.174	0.2098	
30	0.044	118	911.9640	83	0.900	900.54	101.3	4.850	0.171	0.2098	
40	0.044	118	917.1300	85	0.900	900.54	100.4	4.823	0.170	0.2098	
50	0.044	115	922.3580	89	0.900	898.20	99.9	4.845	0.171	0.2098	
60	0.044	112	927.5970	90	0.900	895.86	99.4	4.847	0.174	0.2098	
70	0.044	108	932.8580	92	0.900	892.72	98.8	4.850	0.174	0.2098	
80	0.044	107	938.1310	93	0.900	891.94	98.6	4.852	0.175	0.2098	
90	0.044	106	943.4160	94	0.900	891.15	98.3	4.854	0.173	0.2098	
100	0.044	105	948.7080	94	0.900	890.36	98.4	4.861	0.174	0.2098	
110	0.044	104	953.9890	94	0.900	889.57	98.1	4.850	0.172	0.2098	
120	0.044	103	959.2910	95	0.900	888.78	98.2	4.870	0.173	0.2098	
130	0.044	102	964.5780	96	0.900	888.00	97.3	4.838	0.174	0.2098	
140	0.044	102	969.8800	96	0.900	888.00	97.6	4.852	0.174	0.2098	
150	0.044	102	975.0880	96	0.900	888.00	95.9	4.766	0.174	0.2098	
160	0.044	101	980.4860	96	0.900	887.21	99.3	4.940	0.174	0.2098	
170											
180											
190											
200											
210											
220											
230											
240											
250											
260											
270											
280											
290											
300											
310											
320											
330											
340											
350											
360											
370											
380											

MYREN CONSULTING, INC.
6 Inch Dilution Tunnel Traverse Data

Unit: Kuma V.3
Run #: 7/19 110
Date: EPA 4
Technicians: CO ATM

Rev 2/22/09

Point	Location	Δp	$\sqrt{\Delta p_{trav}}$	$\sqrt{\Delta p_{cent}}$	#12 T_{trav}	#12 T_{cent}	Pg
W-1	0.5"	.039	.1975		102		
2	1.5	.044	.2098		102		
Center	Center	.044		.2098		103	-.172
3	4.5	.043	.2074		104		
4	5.5	.042	.2049		104		
S-1	0.5	.038	.1949		102		
2	1.5	.042	.2049		101		
Center	Center	.042		.2049		101	-.169
3	4.5	.043	.2074		101		
4	5.5	.039	.1975		101		
	Totals		1.6243	.4147	817.0	204	-.3410
	Average		.2030	.2074	102.1	102	-.1705
	°R = (°F + 460)				562.1	562.0	

BP: 28.34 in. Hg Ps = BP+(Pg/13.6) = 28.34 + (-.1705/13.6) = 28.327 in. Hg

LEAK CHECKS:
Pre Test: Pg Leg: OK JRP Velocity Head Leg: OK JRP
Post Test: Pg Leg: OK ATM Velocity Head Leg: OK ATM

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 V.3 DATE: 7/19/10 RUN #: EPA 4 TECHNICIAN(S): CO ATM

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) (.2030 $\bar{x}$ $\sqrt{\Delta P}$ "H_2O) $\sqrt{\frac{562.1 \text{ Ts °A}}{\{0\}}}$ = 14.32102 fps

{2} {2}

(28.327 Ps "Hg) (28.56 lb./ lb. mole) {2}

{2}

(9A) Vs = (14.32102 fps) (60) = 859.261 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) (.2074 $\bar{x}$ $\sqrt{\Delta P}$ "H_2O) $\sqrt{\frac{562.0 \text{ Ts °A}}{\{0\}}}$ = 14.63012 fps

{2} {2}

(28.327 Ps "Hg) (28.56 lb./ lb. mole) {2}

{2}

(9A) Vs = (14.63012 fps) (60) = 877.807 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 = 14.32102 ÷ 14.63012 = .97887

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) (14.32102 fps) (.1963 ft^2) [(528 °A) (28.327 Ps "Hg) / (562.1 T_s °A) (29.92" Hg) =

{2} {3} {2} {0}

8,640.270 dscfhr (or dscfh)

{1}

(10A) 8640.270 dscfhr ÷ 60 = 144.004 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.

M5G-1

Unit: Kuma V.2
Run: EPA 4
Date: 7/19/10
Page 1 of 1 Rev 5/10

Method 5G Particulate Sampling Data

Meter Box 45G-P Meter Y 1.0159 Filter #'s: (F) 123 (R) 122

.242/.242 Filter/O-Ring ID #: —

Pre Test Leak Check: .000 CFM@ -15.5 in Hg Filter Size: 110 mm

.584/.585 Probe ID #: —

Post Test Leak Check: .000 CFM@ -15.25 in Hg Probe Length 21.5 in

Time		Meter Reading (ft³)	Pitot		Tunnel Temp (°F)	Meter Temp (°F)	Gas Meter Δh	Vac (in Hg)
Clock	Elapsed		ΔP	Pg				
1150	00	896.401	.042	-.164	99	72	0.90	0
1200	10	901.614	.041	-.169	114	74	.90	0
10	20	906.788	.044	-.174	117	78	.90	0
20	30	911.964	.044	-.171	118	83	.90	0
30	40	917.130	.044	-.170	118	85	.90	0
40	50	922.358	.044	-.171	115	89	.90	0
50	60	927.597	.044	-.174	112	90	.90	0
1300	70	932.858	.044	-.174	108	92	.90	0
10	80	938.131	.044	-.175	107	93	.90	0
20	90	943.416	.044	-.173	106	94	.90	0
30	100	948.708	.044	-.174	105	94	.90	0
40	110	953.989	.044	-.172	104	94	.90	0
50	120	959.291	.044	-.173	103	95	.90	0
1400	130	964.578	.044	-.174	102	96	.90	0
10	140	969.880	.044	-.174	102	96	.90	0
20	150	975.088	.044	-.174	102	96	.90	0
30	160	980.486	.044	-.174	101	96	.90	0
	70							
	80							
	90							

BP

00	28.34		
60	28.33		
120	28.32		
160	28.32		
		Avg. =	28.3275

Pre Test Filter Check Weighing
F .6568
R .6564

.6714 .6581
End of Test Weight

F	R
.6722	.6582
.6568	.6564
.0154	.0018
14.6	1.7

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

Into Dessicator: Date 11/20/09 Time 1026 By PDQ Front Half ✓ Back Half ✓

Manufacturer: PALL P/N 60115 Size: 110 mm Lot.No.: T72680 Grade: A/E GLASS

Filter #	First Wt	2010 Date	Time	By	Second Wt	2010 Date	Time	By	Third Wt	Date	Time	By
101	.6559	1/21	1103	PDQ	.6559	7/6	1802	AM				
102	.6532		1104	PDQ	.6533		1800	AM				
103	.6557		1105	PDQ	.6551		1801	AM				
104	.6545		1106	PDQ	.6545		1800	AM				
105	.6556		1107	PDQ	.6555		1759	AM				
106	.6545		1108	PDQ	.6546		1758	AM				
107	.6546		1109	PDQ	.6547		1757	AM				
108	.6522		1110	PDQ	.6524		1756	AM				
109	.6558		1111	PDQ	.6557		1755	AM				
110	.6531		1112	PDQ	.6530		1754	AM				
111	.6511		1113	PDQ	.6510		1753	AM				
112	.6538		1114	PDQ	.6537		1752	AM				
113	.6553		1115	PDQ	.6553		1751	AM				
114	.6548		1115	PDQ	.6550		1750	AM				
115	.6533		1116	PDQ	.6536		1749	AM				
116	.6580		1117	PDQ	.6579		1748	AM				
117	.6543		1118	PDQ	.6545		1747	AM				
118	.6564		1119	PDQ	.6564		1747	AM				
119	.6564		1120	PDQ	.6562		1746	AM				
120	.6548		1121	PDQ	.6549		1745	AM				
121	.6526		1122	PDQ	.6527		1744	AM				
122	.6565		1123	PDQ	.6564		1743	AM				
123	.6567		1124	PDQ	.6568		1743	AM				
124	.6560		1125	PDQ	.6552		1742	AM				
125	.6528	—	1126	PDQ	.6528	✓	1741	AM				

Checked by AT, MY, MW Date: 7/6/10 Time 1805

QA REWEIGH

Filter #	WT	Date	Time	By
106	.6545	7/7/10	0657	JM
115	.6533	7/7/10	0658	JM
121	.6525	7/7/10	0659	JM

POST 11/21 7/6 7/16
0.0000 0.0000 0.0000
00.0000 99.9992 99.9990

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	2010 Date	Time	By
56	72	34	11/21	0952	PDQ
58	70	48	7/6/2010	1630	ATM
58	70	48	7/7/10	0645	ATM

Woodstove Data Sheet #4-2: Initial Beaker Weights (Tare Weights)

Into Dessicator: Date 7-12-10 Time 1313 By JRP

Balance Used: Sartorius 2 Model: ~~CP224S~~ CPA 225 SN: ~~17050374~~

Beaker #	First Wt	2010 Date	Time	By	Second Wt	2010 Date	Time	By	Third Wt	Date	Time	By
20	73.3182	7/14	1643	PDO	73.3193	7/15	1419	JRP	73.3188	7/16	1824	
21	71.0024	"	1644	PDO	71.0006	7/15	1417	JRP	71.0025	7/16	1822	
28	70.5972	"	1646	PDO	70.5977	7/15	1415	JRP	"	"	"	
32	53.6005	"	1647	PDO	53.6006	7/15	1414	JRP	53.6009	7/20	2221	
34	53.2616	"	1648	PDO	53.2620	7/15	1412	JRP				
35	53.2815	"	1649	PDO	53.2818	7/15	1210	ATM	53.2818	7/20	2218	
38	53.2525	"	1650	PDO	53.2530	7/15	1209	ATM	53.2534	7/20	2220	
39	53.1509	"	1651	PDO	53.1510	7/15	1206	ATM				
42	53.8698	"	1652	PDO	53.8688	7/15	1147	ATM	53.8704	7/16	1820	
25	72.6522	7/20	2233		72.6522	7/27	2240	ATM				
Into Dessicator 7/16/10 @							1750	ATM				
41	53.8380	7/17	1843	ATM	53.8376	7/18	2045					
43	53.2328	7/17	1850	ATM	53.2328	7/18	2058					
29	71.5188	7/20	2223		71.5186	7/27	2246	ATM				
42	53.8704	7/17	1834	ATM	53.8686	7/27	2248	ATM				
21	71.0024	7/17	1837	ATM								
22	71.8334	7/20	2222		71.8330	7/27	2249	ATM				
Into Dessicator 7/12/10 @							1922	ATM				
31												
32	70.7848	7/20	2211		70.7854	7/27	2237	ATM				
40	53.4631	7/20	2212		53.4683	7/27	2236	ATM				
24	73.2483	7/20	2213		73.2181	7/27	2234	ATM				

Checked by _____ Date: _____ Time: _____

QA Reweigh

Beaker #	WT	Date	Time	By
28	70.5982	7/16	1824	

Balance Room Environmental Conditions

WB	DB	%RH	Date 2010	Time	By
62	75	46	7/14	1680	PDO
60	73	46	7/15	1128	ATM
61	75	44	7/16	1810	ATM
60	73	46	7/17	1800	ATM
61	74	47	7/18	2015	ATM

Post Weighing	Date	1st	2nd	3rd	4th	5th
Scale Check	0.0000g	0.0000	0.0000	0.0000	0.0000	0.0060
	100.0000g	99.9994	99.9994	99.9994	99.9995	9.9995

6th 0.0000

Woodstove Data Sheet #4-2: Initial Beaker Weights (Tare Weights)

Scale 2

Into Dessicator: Date 4 May 10 Time 0940 By ATM

Balance Used: Sartorius Model: CP224S SN: [redacted]

Beaker #	First Wt	Date	Time	By	Second Wt	2010 Date	Time	By	Third Wt	Date	Time	By
20	3171	5/5	1453	ATM	73.3176	5/7	1641					
01	71 .0018		1504	ATM	71.0022	5/7	1704		71.0018	5/8/10	1245	ATM
22	71 .8330		1503	ATM	71.8344	5/7	1705		71.8337	5/8/10	1246	ATM
23	70 .7386		1455	ATM	70.7392	5/7	1708		70.7395	5/8/10	1227	ATM
24	73 .2178		1456	ATM	73.2187	5/7	1700		73.2187	5/8/10	1229	ATM
25	72 .6512		1459	ATM	72.6516	5/7	1650		72.6511	5/11/10	1447	ATM
26	71 .7872		1507	ATM	71.7879	5/7	1647		71.7875	5/11/10	1438	ATM
27	72 .3304		1508	ATM	72.3311	5/7	1657		72.3305	5/8/10	1243	ATM
29	71 .5185		1510	ATM	71.5198	5/7	1656		71.5193	5/11/10	1543	ATM
30	70 .9552		1511	ATM	70.7856	5/7	1658		70.7855	5/11/10	1541	ATM
32	53 .5981		1506	ATM	53.5999	5/7	1702		53.5996	5/8/10	1235	ATM
33	53 .1475		1505	ATM	53.1488	5/7	1701		53.1484	5/11/10	1437	ATM
36	53 .8736		1501	ATM	53.5744	5/7	1707		53.5742	5/8/10	1233	ATM
38	53 .2513		1500	ATM	53.2523	5/7	1703		53.2520	5/8/10	1239	ATM
40	53. 4617		1457	ATM	53.4625	5/7	1706		53.4624	5/8/10	1236	ATM
41	52. 8355		1458	ATM	52.8364	5/7	1707		52.8368	5/8/10	1229	ATM
43	53 .2379	↓	1440	ATM	53.2383	5/7	1640					
31	69 .6666	5/7/10	1655		69.6666	5/11	1445	ATM				
37	53 .7263	5/7/10	1646		53.7259	5/11	1440	ATM				
(cont.)												
22	71.8338	5/11/10	1623									
27	72.3287	5/11/10	1622		72.3305	5/12/10	1500	ATM	72.3304	6/2/10	1620	

Checked by ATM Date: 6/2/10 Time: 1610

QA Reweigh

Beaker #	WT	Date	Time	By
22	71.8339	6/2/10	1617	ATM
32	53.5997	6/2/10	1619	
21	71.1002	6/2/10	1620	

Balance Room Environmental Conditions

WB	DB	%RH	Date	Time	By
59	73	42	5/7/10	1600	ATM
59	71	48	5/8/10	1140	ATM
55	69	42	5/11/10	1349	ATM
60	73	46	5/12/10	1314	ATM
61	75	44	6/2/10	1602	ATM

Post Weighing	Date	1st	2nd	3rd	4th	5th	6th
	0.0000g	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Scale Check	100.0000g	99.9996	99.9995	99.9995	99.9995	99.9995	99.9995

M5G-1 Unit Kuk V.3

Woodstove Data Sheet #4-3: Constant Final Weights

Run # EPA 4

Date: 7/19/10

50 ml

WST5-Form 9, Pg 1, Rev 5/10

Final Beaker Weights

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
41	52.8390	7/20	1145	AM	52.8417	7/20	2138	JM	52.8394	7/21	2204	JM	52.8402	7/22	2243	AM
					52.8405	7/28	1428	JM	52.8403	7/29	1350	ATM	X			
										X						

Final Filter Weights

	Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
F	123	.6722	7/19	1615	ATM	.6714	7/20	2143	JM	(.6714)	7/21	1726	ATM	X			
R	122	.6564	7/19	1615	ATM	.6583	7/20	2142	JM	.6581	7/21	1730	ATM	.6578	7/22	1644	ATM

QA Reweigh: Final Weight

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

Scale Room Environmental Conditions

Weighing Session	2010 Date	Time	By	WB	DB	%RH
1	7/20	1350	ATM	59	72	45
2	7/21	1715	ATM	63	77	45
3	7/22	1617	ATM	61	74	46
4	7/26	2141	ATM	62	76	45
5	7/27	2206	ATM	63	76	49
6	7/28	1340	ATM	64	77	49

Scale Room Environmental Conditions

7	7/29	1330	64	77	49
8					
9					
10					
11					

Comments

Acetone Blank 7/13/10
Bkr 29 50ml Acetone Kuma
Lot # 074092 Tare Wt. 71.5193

Woodstove Data Sheet #4-3: Constant Final Weights

Unit Kuma V3
Run # EPA 4
Date: 7/19 TO

WSTS-Form 9, Pg 1, Rev 5/10

Final Beaker Weights

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
29	71.5194	7/30	1546	AM	71.5180	8/1	1111	ATM	71.5195	7/31	2028	JC	71.5194	8/1	0941	ATM

Final Filter Weights

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

QA Reweigh: Final Weight

Date	Beaker #	Final Wt	By

Date	Filter #	Final Wt	By

Scale Room Environmental Conditions

Weighing Session	Date	Time	By	WB	DB	%RH
1	7/31	1020	ATM	58	72	42
2	7/31	2005	ATM	64	77	49
3	8/1	0936	ATM	64	77	49
4						
5						
6						

Scale Room Environmental Conditions

7					
8					
9					
10					
11					

Comments

Woodstove Data Sheet 4-4 Scale QC Record Sheet

Scale 1

From: 7/20/10
Through: _____

Scale: Sartorius
Model: CP224S
SN: 17050374
Rev: 3/10

* 135.00000 g = 100.00000 + 20.00000 + 10.0000 + 5.0000 wts. 100g wt = 99.9991 - 90

Level	Recalibrated	130g * Weights	100g Weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	2010 Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9988	99.9989	9.9999	1.0000	0.1000	0.0199	7/20	1350	ATM	28.36	59	72	45	118
Yes	Yes	134.9988	99.9989	9.9999	0.9999	0.0999	0.0199	7/21	1715	ATM	28.22	63	77	45	117
Yes	No	134.9988	99.9989	10.0000	1.0000	0.1000	0.0199	7/22	1617	ATM	28.16	61	74	46	119
Yes	Yes	134.9989	99.9990	9.9999	1.0000	0.0999	0.0199	7/26	2141	ATM	28.15	62	76	45	120
Yes	No	134.9990	99.9991	9.9999	1.0000	0.0999	0.0199	7/27	2200	ATM	28.32	63	76	49	119
Yes	No	134.9991	99.9992	9.9999	1.0000	0.1000	0.0199	7/28	1340	ATM	28.34	64	77	49	116
Yes	No	134.9989	99.9990	9.9999	1.0001	0.1001	0.0200	7/29	1330	ATM	28.41	64	77	49	115
Yes	No	134.9990	99.9991	9.9999	1.0000	0.1000	0.0199	7/30	1639	ATM	28.25	64	77	49	116
Yes	No	134.9989	99.9989	9.9999	0.9999	0.0999	0.0199	7/31	1020	ATM	28.29	58	72	42	116
Yes	No	134.9990	99.9991	9.9999	1.0000	0.1000	0.0199	7/31	2005	ATM	28.22	64	77	49	119
Yes	Yes	134.9988	99.9989	9.9999	0.9999	0.1000	0.0199	8/1	0926	ATM	28.32	56	68	46	116
Yes	No	134.9988	99.9989	9.9999	1.0001	0.0999	0.0199	8/1	2050	ATM	28.30	61	74	47	117
Yes	Yes	134.9988	99.9989	9.9999	1.0001	0.1000	0.0199	8/2	0756	ATM	28.40	58	70	48	117
Yes	Yes	134.9988	99.9989	9.9999	1.0000	0.1001	0.0199	8/3	1600	JRP	28.34	58	70	48	116

Woodstove Data Sheet 4-4 Scale QC Record Sheet All Scales and Desiccators Individually Grounded Now.

Scale 1

From: 5/31/10
Through: 7/19/10

Scale: Sartorius
Model: CP224S
SN: 17050374
Rev: 3/10

* 135.0000g = 100.0000 + 20.0000 + 10.0000 + 5.0000 wts. 100g wt = 99.9991-99.9990

Level	Recalibrated	130g* Weights	100g Weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9992	99.9992	9.9999	1.0001	0.1001	0.0200	5/31/10	10:45	ATM	28.21	58	70	48	120
Yes	No	134.9992	99.9993	10.0000	1.0001	0.1001	0.0200	6/1/10	14:45	ATM	28.22	57.5	70	46	119
Yes	Yes	134.9990	99.9990	9.9999	1.0001	0.1000	0.0199	6/2/10	1602	ATM	28.09	61	75	46	118
Yes	Yes	134.99889	99.9989	9.9999	0.9999	0.1000	0.0201	6/3/10	1450	ATM	28.20	57	69	46	120
Yes	No	134.9991	99.9991	9.9999	1.0000	0.1001	0.0199	6/4/10	0950	ATM	28.09	55	68	42	120
Yes	No	134.9989	99.9990	9.9999	0.9999	0.1000	0.0199	6/7/10	1350	ATM	28.40	60	72	49	119
Yes	No	134.9989	99.9990	9.9999	1.0000	0.1000	0.0199	6/10/10	1545	ATM	28.395	58	70	48	121
Yes	No	134.9990	99.9990	9.9999	1.0000	0.1000	0.0199	6/11/10	1440	ATM	28.57	61	74	46	120
Yes	No	134.9990	99.9991	9.9999	1.0000	0.1001	0.0200	6/13/10	2035	ATM	28.33	58	71	44	120
Yes	No	134.9991	99.9990	10.0000	1.0001	0.1001	0.0199	6/15/10	1438	ATM	28.28	59	72	45	120
Yes	No	134.9990	99.9990	10.0000	0.9999	0.1000	0.0199	6/22/10	2041	ATM	28.45	58	70	48	121
Yes	No	134.9993	99.9993	10.0000	1.0000	0.1000	0.0199	6/23/10	2230	ATM	28.45	64	77	48	118
Yes	Yes	134.9989	99.9989	9.9999	0.9999	0.1000	0.0199	6/27/10	1710	ATM	28.29	60	74	43	117
Yes	Yes	134.9989	99.9989	9.9999	0.9999	0.0999	0.0199	6/29/10	1407	ATM	28.20	61	74	47	119
Yes	Yes	134.9989	99.9989	9.9999	1.0001	0.1001	0.0199	7/5/10	1705	ATM	28.38	58	70	48	118
YES	Yes	134.9988	99.9989	9.9999	0.9999	0.1000	0.0199	7/6/10	1250	JRP	28.48	57	68	50	118
Yes	Yes	134.9988	99.9989	9.9999	1.0000	0.1000	0.0199	7/6/10	1630	ATM	28.52	58	70	48	121
Yes	Yes	134.9988	99.9989	9.9999	1.0000	0.0999	0.0199	7/7/10	0645	ATM	28.52	58	70	48	120
Yes	No	134.9992	99.9992	9.9999	1.0000	0.1000	0.0199	7/8/10	1409	ATM	28.45	64	77	49	117
Yes	No	134.9991	99.9992	9.9999	1.0000	0.1000	0.0199	7/10/10	2145	ATM	28.04	61	74	46	110
Yes	No	134.9991	99.9992	9.9999	1.0000	0.1000	0.0199	7/12/10	1109	ATM	27.95	60	72	48	119
Yes	Yes	134.9988	99.9989	9.9999	1.0000	0.1000	0.0199	7/13/10	1426	ATM	28.35	55	67	45	119
Yes	No	134.9988	99.9989	9.9999	1.0001	0.1001	0.0200	7/14/10	1444	ATM	28.48	58	70	48	117
Yes	No	134.9988	99.9989	9.9999	1.0000	0.1000	0.0199	7/15/10	1128	ATM	28.43	60	73	46	116
Yes	No	134.9989	99.9990	9.9999	0.9999	0.1000	0.0199	7/16/10	1810	ATM	28.28	61	75	44	116
Yes	No	134.9989	99.9990	9.9999	0.9999	0.0999	0.0199	7/17/10	1800	ATM	28.29	60	73	46	120
Yes	No	134.9991	99.9991	10.0000	1.0000	0.1000	0.0199	7/18/10	2015	ATM	28.25	61	74	47	120
Yes	No	134.9989	99.9990	9.9999	1.0000	0.1000	0.0199	7/19/10	1040	ATM	28.40	60	73	46	116

Woodstove Data Sheet 4-4 Scale QC Record Sheet

Scale 1

From: 4/4/10
Through: 5/18/10

Scale: Sartorius
Model: CP224S
SN: 17050374
Rev: 3/10

* 135.0009 = 100.0000 + 10.0000 + 10.0000 + 5000 100g wt 99.9991 - 99.9990

Level	Racali-brated	135g * weight5	100g weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9993	99.9993	9.9999	1.0001	0.1000	0.0200	4/4/10	1836	ATM	28.03	57	70	44	
Yes	No	134.9992	99.9992	9.9999	1.0000	0.10000	0.0199	4/5/10	1641	ATM	28.09	58	72	42	
Post Servicing with Quick QC Services Here								4/6/10	1000						LING
Yes	Yes	134.9993	99.9992	9.9999	0.9999	0.1000	0.0200	4/6/10	1130	ATM	28.10	58	72	42	Volts
Yes	Yes	134.9992	99.9992	9.9998	0.9999	0.1000	0.0199	4/6/10	1601	ATM	28.08	60	75	40	
Yes	Yes		99.9988					4/13/10	0945	ATM	28.12	57	70	44	
Yes	Yes	134.9989	99.9990	10.0000	1.0001	0.1001	0.0199	4/13/10	1330	ATM	28.13	60	72	49	
Yes	YES	134.9985	99.9987	9.9998	0.9999	0.0999	0.0199	4/14/10	1445	JRP	28.27	59	71	48	118V
Yes	No	134.9988	99.9989	9.9999	1.0000	0.1001	0.0199	4/14/10	1752	ATM	28.34	60	74	43	120
Yes	NO	134.9988	99.9989	9.9998	1.0000	0.1000	0.0199	4/15/10	1049	PDT	28.43	58	72	42	120V
Yes	No	134.9990	99.9990	9.9999	1.0001	0.1001	0.0200	4/15/10	1605	ATM	28.43	59	71	48	120
Yes	No	134.9992	99.9992	9.9999	1.0001	0.0999	0.0201	4/22/10	1250	ATM	28.23	62	75	47	121
Yes	No	134.9993	99.9993	10.0000	1.0000	0.1001	0.0199	4/24/10	1827	ATM	28.42	58	70	48	119
Yes	No	134.9990	99.9990	10.0000	1.0000	0.1001	0.0200	4/26/10	0921	ATM	28.39	60	74	43	120
Yes	Yes	134.9992	99.9992	9.9999	1.0000	0.0999	0.0199	4/28/10	1249	ATM	27.86	58	70	48	119
Yes	No	134.9992	99.9992	9.9999	0.9999	0.1000	0.0199	4/29/10	1535	ATM	28.08	60	74	43	119
Yes	No	134.9992	99.9992	9.9999	1.0001	0.1001	0.0199	4/30/10	1513	ATM	28.23	57	70	44	120
Yes	No	134.9993	99.9992	9.9999	1.0000	0.1000	0.0199	5/3/10	1511	ATM	27.98	57	70	44	119
Yes	No	134.9990	99.9990	9.9999	1.0001	0.1001	0.0200	5/4/10	2040	ATM	28.48	60	73	46	120
Yes	No	134.9992	99.9992	10.0000	1.0000	0.1000	0.0199	5/5/10	1100	ATM	28.43	61	75	44	117
Yes	Yes	134.9988	99.9989	9.9999	0.9999	0.1000	0.0199	5/6/10	0819	PDT	28.60	59	73	42	120
Yes	No	134.9991	99.9991	10.0000	1.0001	0.1000	0.0199	5/7/10	1600	ATM	28.	59	73	42	122
Yes	No	134.9991	99.9991	9.9999	1.0001	0.1001	0.0200	5/10/10	1140	ATM	28.38	59	71	48	120
Yes	No	134.9991	99.9990	9.9999	1.0000	0.1000	0.0199	5/11/10	1349	ATM	28.39	55	68	42	119
Yes	No	134.9989	99.9989	9.9999	0.9999	0.1000	0.0199	5/12/10	1314	ATM	28.34	60	73	46	120
Yes	No	134.9990	99.9990	10.0000	1.0000	0.1000	0.0200	5/13/10	1340	ATM	28.37	62	75	47	119
Yes	No	134.9989	99.9990	10.0000	1.0001	0.1000	0.0200	5/14/10	0630	ATM	28.31	58	71	44	120
Yes	NO	134.9991	99.9991	9.9999	1.0001	0.1000	0.0199	5/18/10	1445	ATM	28.24	60	72	49	120

WOODSTOVE DATA SHEET 4-4 SCALE QC RECORD SHEET

SCALE: SARTORIUS
MODEL: CP224S
SN: 17050374

FROM: 01/19/2010 - 0739
THROUGH: 2/21/10

Level	Recali brated	130 g Weights	100 g Weight	10 g Weight	1.0 g Weight	100 mg Weight	20 mg Weight	2010 Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
Yes	Yes	139.9992	99.9993	9.9999	1.0000	0.1000	0.0199	1/19	0739	PDG	57	73	35
Yes	Yes	139.9991	99.9994	9.9999	1.0000	0.1000	0.0199	1-20	1427	JRP	57	70	41
Yes	Yes	139.9991	99.9992	9.9999	1.0000	0.1000	0.0199	1/21	0952	PDG	56	72	34
Yes	No	139.9992	99.9993	9.9999	1.0000	0.1000	0.0199	1-22	0719	JRP	55	69	39
Yes	Yes	139.9991	99.9992	9.9999	1.0000	0.1000	0.0199	1/25	1345	PDG	55	69	39
Yes	No	139.9991	99.9992	9.9999	1.0000	0.1000	0.0199	1/27	1345	ATM	59	74	40
Yes	No	139.9993	99.9994	10.0000	1.0001	0.1001	0.0200	1/30	0600	ATM	58	70	48
Yes	No	139.9993	99.9993	10.0000	1.0000	0.1000	0.0199	1/30	1121	PDG	58	74	36
Yes	No	139.9993	99.9994	9.9999	1.0000	0.1000	0.0199	1/31	1550	ATM	59	74	40
Yes	No	139.9992	99.9993	10.0000	1.0000	0.1000	0.0199	2/1	1055	ATM	57	70	41
Yes	No	139.9992	99.9993	9.9999	1.0000	0.1000	0.0199	2/2	1755	ATM	57	71	41
Yes	Yes	139.9991	99.9992	9.9999	1.0000	0.1000	0.0200	2/3	0521	ATM	59	72	43
Yes	No	139.9991	99.9992	10.0000	1.0001	0.1000	0.0199	2/3	1913	ATM	56	68	46
Yes	Yes	139.9991	99.9992	9.9999	1.0001	0.1001	0.0199	2/4	0514	ATM	60	74	43
Yes	Yes	139.9992	99.9993	9.9999	1.0000	0.1000	0.0199	2/5	0547	ATM	59	74	40
Yes	Yes	139.9991	99.9992	9.9999	0.9999	0.1000	0.0199	2/5	1940	ATM	57	69	47
Yes	No	139.9992	99.9993	10.0000	1.0001	0.1001	0.0199	2/6	1925	ATM	57	70	41
Yes	No	139.9993	99.9993	10.0000	1.0001	0.1001	0.0200	2/7	0755	ATM	57	70	41
Yes	Yes	139.9992	99.9992	10.0000	1.0001	0.1001	0.0200	2/8	0810	ATM	56	71	37
Yes	Yes	139.9992	99.9992	9.9999	1.0000	0.1001	0.0200	2/8	2110	ATM	56	69	43
Yes	Yes*	134.9992	99.9992	9.9999	0.9999	0.1000	0.0199	2/9	1936	ATM	57	70	41
Yes	Yes	134.9992	99.9992	9.9999	1.0001	0.1001	0.0199	2/10	0530	ATM	54	66	44
Yes	No	134.9992	99.9993	10.0000	1.0001	0.1001	0.0199	2/10	1935	ATM	55	67	45
Yes	No	134.9992	99.9992	9.9999	1.0000	0.1000	0.0199	2/11	1553	ATM	56	69	43
Yes	No	134.9993	99.9993	9.9999	1.0001	0.1001	0.0199	2/12	1910	ATM	53	64	46
Yes	No	134.9992	99.9992	10.0000	1.0001	0.1000	0.0199	2/13	1745	ATM	55	66	48
Yes	No	134.9992	99.9992	10.0000	1.0000	0.1000	0.0199	2/14	1905	ATM	55	66	48
Yes	No	134.9992	99.9992	10.0000	1.0000	0.1001	0.0199	2/15	1502	ATM	57	69	47
Yes	Yes	134.9991	99.9992	10.0000	1.0000	0.1000	0.0200	2/16	1909	ATM	55	67	45
Yes	No	134.9994	99.9993	10.0000	1.0000	0.1000	0.0199	2/18	1935	ATM	58	70	48
Yes	No	134.9992	99.9992	9.9999	1.0001	0.1001	0.0199	2/19	1704	ATM	56	69	43
Yes	No	134.9992	99.9992	9.9999	1.0000	0.1001	0.0200	2/20	1305	ATM	54	68	38
Yes	No	134.9993	99.9994	9.9999	1.0001	0.1000	0.0199	2/21	1541	ATM	56	68	46

* Switched to 20 mg wt; weighing 100, 20, 10 & 5 together for 135.0000

Woodstove Data Sheet 4-4 Scale QC Record Sheet
Scale 2

From: 7/27/10
Through: _____

Scale: Sartorius
Model: CPA 2245
SN: 24850860
Rev: 5/10

2010

Level	Recalibrated	135g Weights	100g Weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9996	99.9995	9.9999	1.0000	0.1000	0.0200	7/27/10	2206	ATM	28.32	63	76	49	116
Yes	Yes	134.9994	99.9994	9.9999	0.9999	0.1000	0.0199	7/28/10	1340	ATM	28.34	64	77	49	116
Yes	No	134.9996	99.9996	9.9999	1.0000	0.1000	0.0199	7/29	1330	ATM	28.41	64	77	49	115
Yes	NO	134.9995	99.9995	9.9999	1.0000	0.0999	0.0199	7/30	1639	ATM	28.25	64	77	49	116
Yes	No	134.9994	99.9994	9.9999	0.9999	0.0999	0.0199	7/31	1020	ATM	28.29	58	72	42	116
Yes	No	134.9995	99.9994	9.9999	1.0000	0.1000	0.0199	7/31	2005	ATM	28.22	64	77	49	119
Yes	No	134.9996	99.9994	9.9999	0.9999	0.0999	0.0199	8/1	0926	ATM	28.32	56	68	46	116
Yes	NO	134.9996	99.9994	9.9999	1.0000	0.1000	0.0199	8/1	2050	ATM	28.30	61	74	47	117
Yes	Yes	134.9995	99.9994	9.9999	0.9999	0.0999	0.0199	8/2	0759	ATM	28.40	58	70	48	117
yes	no	134.9994	99.9994	9.9999	1.0000	0.1000	0.0199	8/2	12:50	SEK	28.37	61	75	46	118
Yes	NO	134.9994	99.9994	9.9999	0.9999	0.1000	0.0199	8/3	1600	JRP	28.34	58	70	48	116
yes	no	134.9996	99.9995	9.9999	1.0000	0.1000	0.0199	8/4	10:20	SEK	28:43	54	66	44	118
Yes	NO	134.9994	99.9994	9.9999	1.0000	0.0999	0.0199	8/5	1000	JRP	28.33	56	67	49	119
yes	NO	134.9996	99.9994	10.0000	1.0000	0.1001	0.0199	8/6	11:24	SEK	28.21	58	72	41	119
Yes	YES	134.9995	99.9995	9.9999	0.9999	0.0999	0.0199	8/8	1446	JRP	28.21	60	73	46	118
yes	NO	134.9995	99.9994	9.9999	0.9999	0.1000	0.0199	8/12	16:43	SEK	28.18	56	68	46	117
Yes	NO	134.9994	99.9995	9.9999	0.9999	0.0999	0.0199	8/14	1457	JRP	28.47	58	70	48	116
Yes	No	134.9995	99.9995	9.9999	1.0000	0.1000	0.0199	8/16	0743	ATM	28.41	56	68	46	119

Woodstove Data Sheet 4-4 Scale QC Record Sheet

Scale 2

From: 4/6/10
Through: 7/26/10

Scale: Sartorius
Model: CPA 2245
SN: 24850860
Rev: 5/10

* 135.0000 g = 100.0000 + 20.0000 + 10.0000 + 5.0000 2010

Level	Recalibrated	135g * Weights	100g Weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9998	99.9997	9.9999	1.0000	0.0999	0.0199	4/6	1601	ATM		60	75	40	
Yes	No	134.9994	99.9994	9.9999	1.0001	0.1001	0.0199	4/13	0945	ATM		57	70	44	
Yes	No	134.9996	99.9996	10.0000	1.0001	0.1001	0.0199	4/13	1338	ATM		60	72	48	
Yes	Yes	134.9993	99.9993	9.9998	0.9999	0.0999	0.0199	4/14	1445	JRP		59	71	48	
Yes	Yes	134.9994	99.9994	9.9998	0.9999	0.0999	0.0198	4/15	1048	PDG	28.43	58	72	42	
Yes	No	134.9996	99.9994	9.9999	1.0000	0.1000	0.0200	4/22	1455	ATM	28.13	62	75	47	
Yes	No	134.9996	99.9996	9.9999	1.0000	0.1000	0.0199	5/5	1100	ATM	28.43	61	75	44	117
Yes	No	134.9996	99.9995	9.9999	0.9999	0.1000	0.0199	5/7	1600	ATM		59	73	42	122
Yes	No	134.9996	99.9995	9.9999	1.0000	0.0999	0.0200	5/8	1140	ATM	28.28	59	71	48	120
Yes	No	134.9995	99.9994	9.9999	1.0000	0.1000	0.0199	5/11	1349	ATM	28.39	55	68	42	119
Yes	No	134.9995	99.9994	9.9999	0.9999	0.1000	0.0199	5/12	1344	ATM	28.34	60	73	46	120
Yes	No	134.9996	99.9995	9.9999	1.0000	0.1000	0.0199	5/13	1340	ATM	28.37	62	75	47	119
Yes	No	134.9996	99.9995	10.0000	1.0001	0.1001	0.0200	5/14	0630	ATM	28.31	58	71	44	120
Yes	Yes	134.9996	99.9994	9.9998	0.9999	0.1000	0.0199	6/2	1602	ATM	28.09	61	75	46	118
Yes	No	134.9996	99.9995	9.9999	1.0000	0.1000	0.0199	6/22	2041	ATM	28.45	58	70	48	121
Yes	Yes	134.9995	99.9994	9.9999	1.0000	0.1000	0.0199	6/23	1710	ATM	28.29	60	74	43	117
Yes	No	134.9994	99.9994	9.9999	1.0000	0.1010	0.0199	6/29/10	1407	ATM	28.20	61	74	47	119
Yes	No	134.9993	99.9993	9.9998	1.0000	0.1000	0.0198	7/14/10	1640	PDG	28.41	62	75	49	118
Yes	No	134.9997	99.9996	9.9999	1.0000	0.1000	0.0199	7/15/10	1128	ATM	28.43	60	73	46	116
Yes	No	134.9996	99.9995	9.9999	1.0000	0.1000	0.0199	7/16/10	1810	ATM	28.28	61	75	44	117
Yes	No	134.9997	99.9996	9.9999	0.9999	0.0999	0.0199	7/17/10	1800	ATM	28.29	60	73	46	120
Yes	No	134.9996	99.9994	9.9999	1.0000	0.0999	0.0199	7/18/10	2015	ATM	28.25	61	74	47	120
Yes	No	134.9996	99.9995	9.9999	0.9999	0.1000	0.0199	7/19/10	1040	ATM	28.40	60	73	46	119
Yes	No	134.9996	99.9994	10.0000	1.0000	0.1000	0.0199	7/20/10	1810	ATM	28.36	62	75	47	118
Yes	No	134.9996	99.9995	9.9999	0.9999	0.0999	0.0199	7/20/10	1350	ATM	28.36	59	72	45	118
Yes	Yes	134.9995	99.9994	9.9999	1.0001	0.1001	0.0199	7/21/10	1715	ATM	28.22	63	77	45	117
Yes	No	134.9996	99.9994	9.9999	0.9999	0.0999	0.0199	7/22/10	1617	ATM	28.16	61	74	46	119
Yes	Yes	134.9994	99.9994	9.9999	0.9999	0.0999	0.0199	7/26/10	2141	ATM	28.15	62	76	45	121

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

Unit: Kuma V.3
Run: EPA 4
Date: 7/19/10
Technicians: ATM
Revised 12/09-Data Sheet #5

Filters

Filter # (front) 123 | Beaker # 41 | Final Wt. 52.8403 g
Final Wt. .6714 g | Ml 50 | Tare Wt. 52.8376 g
Tare Wt. .6568 g | Desc. Acetone | Net Wt. .0027 g
Net Wt. .0146 g

Filter #(Rear) 123 | Beaker # _____ | Final Wt. _____ g
Final Wt. .6578 g | Ml _____ | Tare Wt. _____ g
Tare Wt. .6564 g | Desc. _____ | Net Wt. _____ g
Net Wt. .0014 g

Acetone Blank Calculation: Blank Date: 7/13/10

Blank Beaker # 29 | Final Wt. 71.5194 g
Ml 50 | Tare Wt. 71.5193 g
Desc. Acetone | Net Wt. .0001 g

.0001 g/ 50 ml = .000002 g/ml

Blank Residue Value Calculation:

.000002 g/ml acetone X 50 ml acetone = .0001 g
Blank Residue Value

Total Particulate Catch Calculation:

Filter: .0146 g
Filter: .0014 g
Beakers: .0027 g - .0001 g = .0026 g
Total Catch — Blank Residue Value

Total Catch = .0186 g
18.6 mg

Unit: Kuma V.3
Run # EPA 4
Date: 7/19/10
Technician: AM PDG JRP
WST6-Form1, Rev 5/10

Miscellaneous Test Data
Woodstove Data Sheet #8

Useable Firebox Dimensions: See QC Section Useable Volume: 1.554 ft³

Dilution Tunnel Draft (If Applicable): Start: .000 Stop: .000 Avg: 0.00 in. H_2O

Test Chamber Air Velocity: 10 Start: 13 Stop: _____ Avg: 11.5 ft./m.

Wet Bulb/ Start: WB: 60 °F DB: 76 °F % Amb Moisture: 1.20 %RH: 38

Dry Bulb Stop: WB: 62 °F DB: 78 °F % Amb Moisture: 1.35 %RH: 39

X Ambient Moisture(%Vol.) = 1.275 % X Relative Humidty (%RH) = 38.5 %

Empty Stove Wt: 329.1 lbs.

Empty Stove Wt with Stack (inc oil seal) Wet: 542.9 lbs. Dry: 543.2 lbs. 544.7

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

Kindling Wt. Paper: .2 lbs. Wood: 2.7 lbs. Total: 2.9 lbs.

Pre Burn Fuel Wt. 8.898 + 9.084 + 8.666 Total: 26.648 lbs.

Total Kindling and Pre-Burn Fuel Wt. 29.548 lbs.

Coal Bed Wt-lbs: Range(2.4 - 2.0) 545.6 - 545.2 lbs. Actual: 2.3 lbs.
545.2

Allowable Amount of Charcoal That Can Be Removed:

Coal Bed Wt. Range (2.4 (Upper Wt.) + 2.0 (Lower Wt.) /2) .25 = 0.5 lbs.

Test Fuel Wt-lbs: Ideal 10.9 lbs. Range: 11.9 - 9.8 lbs. Actual: 9.846 lbs.

Test Fuel Size (pcs.) (.75 x 1.5 x 5" Flanges): 14 Pcs. 1.378 lbs.

2 x 4's x 14.375" " 3 Pcs. 6,154 lbs. 62.50 %

4 x 4's x " " 1 Pcs. 3,692 lbs. 37.50 %

3,7138 kg

Est. Dry Burn Rate(Kg/Hr.) $\frac{9.846 - (9.846 \times .16845)}{2.2046} \times \frac{60}{160} =$ 1.3927 Dry Burn Rate (Kg/Hr)

Est EPA Heat Output (HO_E)(Avg BTU's/Hr) (19,140) X $\frac{63}{100}$ x 1.3927 = 16,793 EPA Heat Output (HO_E)BTU's/Hr

120 mins = 1.857 kg/hr.

175 mins = 1.273 kg/hr.

Run: Kuma V.3
Date: EPA 4
Technicians: 7/19/10
Data Sheet #9 Rev 6/10 Pg.5

ATM JRP POS CO.

Stove Operating Data
Woodstove Test Data Sheet #9
Cold Start

Fire Started: 08:28

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 2.00" open. At the run setting until start of the test. 3.341" on rod

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 bet. In stove for 28 seconds.

Test: Door wide open during loading 1 min 21 sec, then closed,

Primary Air: Wide open from the start of the test (0:00) until 4:55. Adjusted to the run setting of 2.00" open between 4:55 and 5:00. At the run setting of 2.00" open at 5:00 into the run.

Secondary Air: No Controls, Naturally drafted

Secondary Burn/[redacted] Bypass: N/A

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

Test Run Anomalies:

Unit Kuma V.3
Run # EPA 4
Date 7/19/10
Technician ATM JRP POG-CO

WST7-Form2-A, Rev 12/09

Woodstove Operating Data
Woodstove Data Sheet # 9A-1

Wood Data: Kindling: A mix of the below grades

	Size	Mill	Grade	Species
Pre Burn	2X4	Forrest Grove	STD & BTR #2	D. Fir & Spf Grw
Test Fuel	2X4	Forest Grove	#2, STD & BTR	D. Fir Spf Grw
	4X4	Mauka Tacoma	#1, STD & BTR	D. Fir Spf Grw

All grades WCLB Rules Unless otherwise noted

Warm Up Information:

1st Warm Up/Pre Burn Fuel Charge (8.898 lbs) added at 0840.
2nd Warm Up Pre Burn Fuel Charge (9.084 lbs) added at 0939.
3rd Warm Up/Pre Burn Fuel Charge (8.866 lbs) added at 1032.
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 .

The coals were scooped out of the stove immediately prior to adding the 3rd pre burn/warm up fuel charge. The stove [redacted] 0,3 lbs. gained 1.5 lbs of hot coals were put back in the stove.

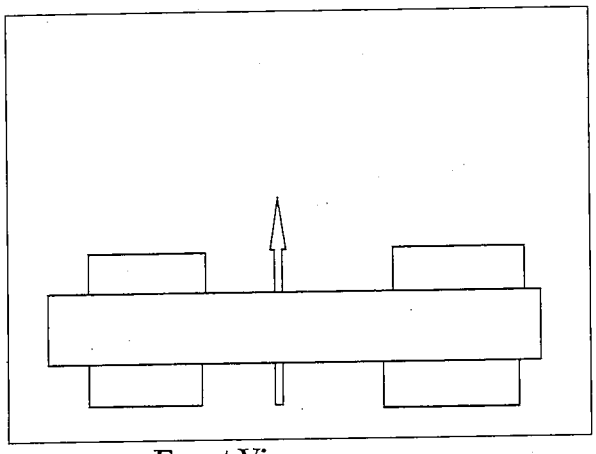
All pre burn/warm up fuel pieces were ~~either~~ _____ or 12 inches long. All pre burn pieces/fuel charges were "ricked" in the stove. The pieces in the bottom layer in each rick contained 2 pieces that were 12 inches long and were loaded flat and perpendicular to the door. The pieces in the second layer in each rick were loaded on their side (edge) approximately parallel to the door and contained 3 pieces 12 inches long. The third layer (and fourth layer if present) was loaded flat, perpendicular to the door and contained 2 pieces 12 inches long. The majority of the pieces in each rick were in the second layer. (The loading directions indicate the direction of the longest dimension on each piece relative to the loading door opening.) Third rick had 6-12" pcs, 2 in 1st Layer, 4 in 2nd

Unit Kuma V.3
Run # EPA 4
Date 7/19/10
Technician AM JRC POG
Page 2 of 4
WST7-Form 2A, Rev 12/09

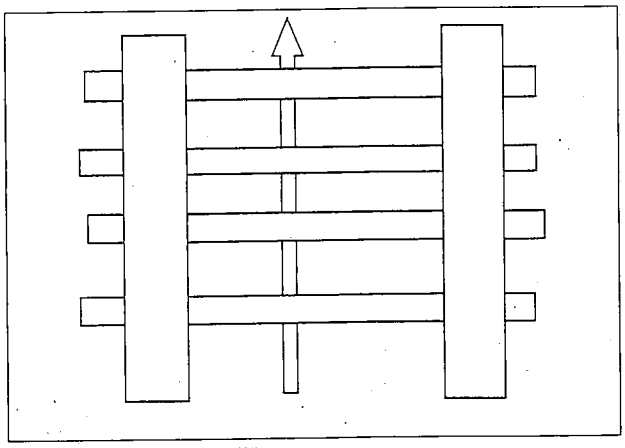
Wood Stove Operating Data
Wood Stove Data Sheet #9A-2

Warm Up Information (cont.):

Each warm up/preburn fuel charge was ricked in exactly (as much as possible) the same manner. The physical arrangement and alignment of the pieces in 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 collapsed or fallen down state) until 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 hot as quickly as possible during the warm up period, thereby maximizing the amount of heat (BTU's) stored in the stove. For this stove, the thermal storage was monitored using the Top (#4) surface temperature (s) and the peak value (s) obtained were 1095 °F 1095



Front View



Top View

The arrows indicate the direction of the air flow through the rick. Note: The top and bottom layers may be offset

The primary air was adjusted to the run setting of 2.000" open 4.5 lbs above the upper charcoal bed weight.

Unit: Kuma V3
Run #: EPA 4
Date: 7/19/10
Technician: AJM JRP PDG
Page 3 of 4
WST5-Form2, Rev 12/09

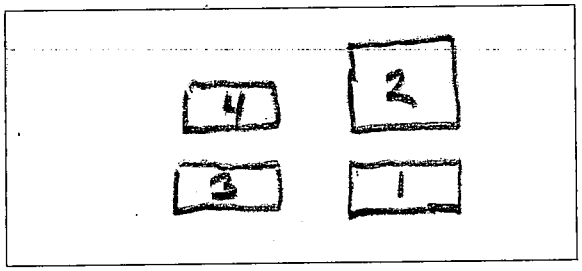
Woodstove Operating Data
Woodstove Data Sheet #9A-3

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 LPAO ⑥ Closed door

Total Elapsed Time: 1:21
Photo Taken @: ~ 3:15

Test Fuel Charge Loading Information:

Test Fuel Charge and Loading Sequence Diagram



END of Stove View
4 X 4's: R
2 X 4's: 1, 3, 4
Loading Sequence: 1, 2, 3, 4
Driest Pcs in Load 1, 3

Loaded the test fuel charge on an essentially level, Average to Small sized, medium coal bed (in appearance, color and temperature) for a M. High burn rate.

Ignition: ~ 0:50 Load 1:21 Door Closed 1:21
1:30 VC up to baffle
3:30 Flames forward past front tube
3:50 Front tube starting to ignite
4:10 Secondaries Full Width of 2 x 4
(4:45) 13.1 / 1.12 Gas Balance
5:00 PAC adjusted from wide open to new setting (2.00" open).

Unit Tecumseh V.C
Run # EPA 4
Date 7/19/10
Technician KJM
Page 4 of 4
WST5-Form2-Rev10/88

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-4

Additional Comments: 5:00 (Cont.) maintained a hot pocket of coals in front of the LPBS with a VC up to baffle + secondary flames over full width of 2 # 4 + Front lobe was aligning on f/b: 14.46 / 1.62 W out of balance @ 5:00

6:10 13.53/.74 Gas balance

12:25 15.08/.72 W

15:32 out of balance. Yellow flames up the front of 5. More and more of these yellow flames

16:14 16.20 / 1.06 Light

21:15 16.13 / 1.74 " / M. Light

21:30 Air wash secondaries flashing on R. Side of air wash

25:03 Back in balance.

25:35 15.31 / 1.52 Still lots of yellow flames up fronts of fuel pucks

30:00 Fan On Low

Unit: Kuma V.3
Run: EPA 4
Date: 7/19/10
Technician: ATM

Fuel Moisture
Woodstove Test Data Sheet # 10

WST1-Form7-Rev 7/10

Room Temperature: 62.0 °F Correction Factor: +0.8 Ohaus Range Scale Check

Note: Record readings to the nearest 0.1% moisture

Uncor Values are corrected for temperature: Yes ____ No ✓

Time Test Fuel Moisture Readings Taken at: 0942 PDST.

Moisture Meter: Delmhorst Model: J-2000 SN: 34284

Calibration Checks: 12.0 12.0 MCS-1: 12.7 12.8 23.6 23.8

0.000lb.: 0.000
1.0 kg = 2.204
5.0 kg = 11.026

PC #	Dimen	Use	Top	Bottom	Side	Piece Avg	± Temp Cor.	Piece Avg Corrected	
1	3 pcs.	K	10.1	8.5	8.9	9.167	+0.8	9.967	
2									
3	2X4 - 8'	P	18.6	19.5	21.4	19.833	+0.8	20.633	
4	↓	↓	20.4	18.7	19.5	19.533		20.333	
5	↓	↓	19.3	22.7	21.3	21.100		21.900	
6	↓	↓	19.7	18.6	19.5	19.267		20.067	
7								82.933	
8									
9									lbs.
10	2X4 - 14.375"	T	18.7	19.4	19.7	19.267	+0.8	20.067	1.760
11	↓	↓	18.7	18.9	18.9	18.833	↓	19.633	1.376
12	↓	↓	19.4	21.2	21.0	20.533	↓	21.333	1.910
13									
14	4X4 - 14.375"	T	19.2	19.0	19.4	19.200	+0.8	20.000	3.422
15								81.033	
16									
17	5x1.5 X.75	T	22.8	19.4	19.3	20.500	+0.8	21.300	1.378
18	(Spacers)							OUT - Spacers	
19									
20									

	Kindling	Pretest Fuel	Test Load
% Moisture – Dry Basis:	9.967 %	20.733 %	20.258 %
% Moisture – Wet Basis:	9.063 %	17.173 %	16.845 %

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

Acceptable Ranges: 16-20% wet; 19-25% dry

Key For Use: K= Kindling P= Pretest Fuel T= Test fuel

4X4 3.692

1. 8.898 lbs. 7 pcs
2. 9.084 lbs 7 pcs
3. 8.866 lbs 6 pcs.
T 9.846 lbs

Unit: Kuma V.3
Run#: EPA 4
Date: 7/19/10
Technician: ATM

WST2-form11-Rev 6/90

WOOD DENSITY DETERMINATION
WOODSTOVE TEST DATA SHEET #11

Wood Piece: Nominal Dimensions: 2X4 — 3.5 x 3S x 1.5

Depth (D): 3.86 cm
Width (W): 8.800 cm
Length (L): 8.990 cm
8.975 cm
8.975 cm
8.960 cm

Length $\bar{X}$ = 8.975 cm

Volume: 304.863 cm^3 (D X W X L)

MOISTURE: Room Temperature: 62 °F Correction Factor: 10.8

Uncorrected Meter Readings Corrected for temperature: Yes ___ No ✓

NOTE: Record moisture meter readings to the nearest 0.5%

	Uncor	Cor
Top:	19.0	19.0 %
Bottom:	18.7	18.7 %
Side:	18.4	18.4 %
$\bar{X}$:		18.700 % + 0.8

Avg % Moisture (Dry) 19.500 %
Aug % Moisture (Wet) 16.318 %

Scale: Leveled In ✓ Out ✓
Zeroed: In ✓ Out ✓

Wet Weight: 149.8 g Dry Weight: 131.8 g

% Moisture Dried Basis: 12.016 %
[1 - (Dry Wt ÷ Wet Wt)] X 100

	Date	Time	Temp
Into Dryer	7/19/10	1905	180 °F
Out of Dryer	7/29/10	1123	202 °F

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

Density = 131.8 g (dry wt) ÷ 304.863 cm^3 (volume) = 0.4323 g/cm^3

Pellet Fuel Moisture Content Determination

Tare Beaker Wt. = ___ g

Wet Wt: ___ g (Gross Wet Wt.) - ___ g (Tare Beaker Wt.) = ___ g (Net Wet Wt.)

Dry Wt: ___ g (Gross Dry Wt.) - ___ g (Tare Beaker Wt.) = ___ g (Net Dry Wt.)

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

Preburn Start Wt. 550.1 Lbs. Up 4.5 lbs.
Test Start Wt Range 545.6 – 545.2 lbs.
Baro. Pressure 28.38 "Hg

Pre Burn Data Record Sheet #13

T/C plug Loose-fixed

Unit: Kuma V.3 Date: 7/19/10
Run: EPA 4 Technician(s): ATM JZP PDG
Page: 1 of 1 WST2-Form 16, Rev 12/09

Hot Box On 13L 17L

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 Catalytic	11 Room Temp	Static		Comments 3.34" on mod
0 1040	550.1	0.0	580	1036	623	547	625	439	1036	1492	79	-.080		Primary Air Set At 2.00"
5 45	549.2	.9	507	986	630	533	634	434	1027	1490	78	-.075		Secondary Air Set At
10 50	548.4	.8	493	972	635	526	638	479	1046	1518	79	-.074		Fan: ON LOW ✓ 1768 rpm
15 55	547.6	.8	483	965	641	529	644	470	1072	1538	80	-.073		Tunnel on at: 22 min
20 1100	547.0	.6	471	951	651	541	650	464	1086	1481	80	-.071		Buckets Iced ✓
25 05	546.5	.5	447	929	661	557	656	458	1107	1452	79	-.068		Analyzers Spanned
30 10	546.2	.3	413	876	670	570	662	439	1082	1338	79	-.063		Pumps Turned on at: 5L min
35 15	546.0	.2	384	806	677	577	662	426	1057	1295	80	-.060		629.6 ΔT – ΔΔT
40 20	545.8	.2	367	757	678	577	658	420	1023	1164	80	-.058		618.0 - 11.6
45 25	545.7	.1	345	695	669	569	648	411	981	1088	78	-.056		598.4 - 19.6
50 30	545.6	.1	336	667	660	562	637	404	956	1051	78	-.054		586.0 - 12.4
55 35	545.5	.1	319	621	641	546	618	393	924	1013	77	-.051		Tunnel ΔP 563.8 - 22.2
~~X~~													X	Probe In Tunnel
60 1140	545.4	.1	310	600	631	536	606	388	897	946	78	-.050		552.2 - 11.6
65 45	545.3	.1	300	573	616	523	591	380	894	930	78	-.048		536.6 - 15.6
70 1150	545.2	.1	295	555	605	511	579	373	876	913	77	.046		524.6 12.0
75														
80														
85														
90														
95														
100														
105														
110														
115														

Myren Consulting Inc Data Sheet P1 of 3 Unit Kuma V.3 Date 7 / 19 / 10 Run EPA 4

Test En .545 2 ΔT 524.6 Barometric Pressure 28.35 g Gas Flows @ 1.5" Technician(s) ATM JRP G-CSO

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	Stack Temp #3	Stack Static Press
0	1150	555.0	9.8	0	.231	5.76		14.56	.116	1.16	5.0		M	FAN OFF	295	-.046
05	55	554.4	9.2	.6	.266	6.62		13.81	.093	.93	7.1		wispy		438	-.056
10	1200	553.8	8.6	.6	.445	11.04		9.49	.075	.75	14.7	Bal	wisps		415	-.065
15	05	552.9	7.7	.9	.622	15.40		5.50	.099	.99	15.6		Light		461	-.071
20	10	552.0	6.8	.9	.644	15.94		4.09	.174	1.74	9.1	O/B	L → ML		465	-.071
25	15	551.1	5.9	.9	.649	16.07		3.99	.169	1.69	9.5		"		465	-.071
30	20	550.4	5.2	F/.7	.656	16.24		3.97	.138	1.38	11.8	Bal	"	FAN ON	465	-.071
35	25	549.6	4.4	.8	.658	16.29		3.78	.167	1.67	9.8	O/B	ML		460	-.070
40	30	549.0	3.8	.6	.636	15.75		4.40	.150	1.50	10.5	Bal	L		454	-.069
45	35	548.5	3.3	.5	.545	13.50		7.31	.017	.17	79.4		wisps		426	-.066
50	40	548.1	2.9	.4	.532	13.18		7.67	.009	.09	146.5		Clear		414	-.064
55	45	547.8	2.6	.3	.511	12.67		8.19	.008	.08	158.3				397	-.061
Total															5155	-0.781

M5 6-2

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 #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	HB 17	BKT 18
0	1150	555	605	511	579	373	876	913	77	99	210	36	63	60	220	35
05	55	559	581	478	555	471	766	1292	79	118	224	36	69	38	232	35
10	1200	681	569	453	543	475	754	1373	79	114	230	37	76	37	217	35
15	05	801	561	431	531	476	803	1338	78	115	230	37	79	37	218	36
20	10	832	564	430	531	474	854	1327	80	117	229	37	81	37	233	36
25	15	864	576	438	539	471	894	1361	80	118	225	37	82	37	233	36
30	20	881	585	446	548	469	920	1381	81	118	222	37	82	37	229	36
35	25	900	610	455	569	445	979	1395	81	118	221	37	83	37	224	36
40	30	906	621	463	580	435	981	1424	81	118	220	38	83	37	224	36
45	35	871	637	478	593	430	993	1384	81	116	220	38	84	37	227	36
50	40	841	644	485	601	427	1004	1365	83	115	221	39	84	38	233	36
55	45	809	649	492	605	429	999	1373	82	114	219	38	85	37	234	36
Total		9,500	7,202	5,560	6,774	5,375	10,823	15,926	962							

Myren ( )sulting Inc Data Sheet P2 of 3 Unit KUMA 3 Date 7 / 19 / 10 Run PM 4

Test Enu Wt. 545.2 ΔT 524.6 Barometric Pressure 28.33 "hg Gas Flows @ 1.5" Technician(s) ATM JRP PAG CSO

Time E/T min	Time	Scale Wt.	Lbs. Left	Burn Rate	CO_1 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	1250	547.5	2.3	.3	.455	11.28		9.55	.044	.14	80.6	Clear				384	-.059
65	55	547.3	2.1	.2	.402	9.98		10.69	.016	.46	21.7	"				367	-.059
70	1300	547.0	1.8	.3	.381	9.46		11.19	.049	.49	19.3	" R stack leaning w org fl				359	-.055
75	05	546.8	1.6	.2	.379	9.41		11.30	.038	.38	24.8	"				348	-.055
80	10	546.7	1.5	.1	.362	8.99		11.68	.046	.46	19.5	" Fr L stack down - no block				341	-.053
85	15	546.5	1.3	.2	.268	6.67		13.74	.098	.98	(6.8)	" out of bal				320	-.050
90	20	546.4	1.2	.1	.262	6.53		13.84	.107	1.07	6.1	"				312	-.049
95	25	546.4	1.2	0	.251	6.25		14.04	.121	1.21	5.2	"				300	-.046
100	30	546.3	1.1	.1	.244	6.08		14.16	.132	1.32	4.16	" charcoal				296	-.046
105	35	546.2	1.0	.1	.242	6.09		14.12	.139	1.39	4.4					288	-.045
110	40	546.1	.9	.1	.243	6.06		14.18	.133	1.33	4.16					285	-.045
115	45	546.0	.8	.1	.240	5.98		14.28	.128	1.28	4.7					279	-.044
Tot																(3879)	(-.606)

M56-2

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	~~Tube 1~~ H-Box #17	~~Tube 2~~ Bucket #18	Tube 3 #19	H_2O H box #20
60	1250	779	652	495	606	430	983	1265	83	112	219	39	85	38	231	36		
65	55	741	650	497	604	431	965	1153	83	110	221	38	85	38	228	36		
70	1300	719	646	497	602	432	963	1184	82	108	224	38	85	38	228	36		
75	05	688	635	491	596	434	955	1167	81	107	224	38	85	38	228	36		
80	10	669	627	486	593	435	945	1103	82	107	226	38	86	38	228	36		
85	15	629	616	482	587	437	901	1050	82	106	220	37	85	38	228	36		
90	20	605	607	475	578	435	880	1005	82	106	216	37	86	38	229	36		
95	25	572	593	467	566	433	854	978	81	105	214	37	86	37	229	36		
100	30	557	584	461	557	430	837	942	82	105	215	38	86	38	230	36		
105	35	536	573	455	546	428	823	919	81	104	215	38	86	38	230	36		
110	40	525	565	451	538	425	816	914	82	104	217	38	87	38	230	36		
115	45	509	554	446	529	422	810	897	81	103	220	38	86	38	231	36		
Tot		(7,529)	(7,302)	(5,703)	(6,902)	(5,172)	(19,732)	(2,577)	(982)									

Myren C ulting Inc Data Sheet P3 of 3 Unit Kuma V 3 Date 7 / 19 / 10 Run PA4

Test End 1545.2 ΔT 524.6 Barometric Pressure 28.32 "hg Gas Flows @ (1.5") Technician(s) ATM JRP 6 CSO

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	1350	545.9	.7	.1	.239	5.96		14.34	.121	1.21	4.9	.				276	-.043
125	55	545.8	.6	.1	.242	6.03		14.26	.122	1.22	4.9					272	-.043
130	1400	545.7	.5	.1	.245	6.11		14.17	.124	1.24	4.9					270	-.041
135	05	545.6	.4	.1	.243	6.06		14.23	.123	1.23	4.9					268	-.041
140	10	545.5	.3	.1	.250	6.23		14.09	.116	1.16	5.4					265	-.040
145	15	545.5	.3	0	.258	6.43		13.91	.112	1.12	5.7					263	-.040
150	20	545.4	.2	.1	.244	6.08		14.22	.119	1.19	5.1					262	-.040
155	25	545.3	.1	.1	.213	5.32		14.87	.143	1.43	3.7					258	-.039
160	30	545.2	0	.1	.210	5.24		15.00	.131	1.31	4.0					255	-.039
165																(2389)	(-2366) page total
170																(11423)	(-7.753) total
175																(346)	(-.053) ÷ 33 AVG
Tot																	

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	~~Gasifier~~	~~Tube 1~~	Tube 2 #19	Tube 3 #20
120	1350	500	547	444	523	418	802	892	81	103	222	38	86	38	231	36		
125	55	489	538	441	516	413	795	885	81	101	224	38	86	38	231	36		
130	1400	483	533	444	511	411	794	881	82	102	225	38	86	38	231	36		
135	05	476	525	446	506	408	790	870	81	102	224	38	86	38	231	36		
140	10	472	520	448	503	405	787	870	82	102	223	38	86	38	231	36		
145	15	467	514	454	500	401	784	870	82	102	222	38	86	38	232	36		
150	20	463	510	457	498	397	761	845	82	102	222	38	87	38	232	36		
155	25	457	504	454	494	394	737	828	81	101	221	37	87	38	233	36		
160	30	452	500	451	489	394	725	817	83	101	221	38	87	38	233	37		
165		(4259)	(4691)	(4039)	(4540)	(3641)	(6972)	(7758)	(735)									
170		(21288)	(19195)	(15302)	(18216)	(14188)	(28527)	(36261)	(2679)						Dwn	T		
175		(645)	(582)	(464)	(552)	(430)	(864)	(1099)	(81)						Strtup	524.6	ΔT	
Tot															Stop	457.2	-67.4	

9 of 33 AVG

Pre and Post Test Zero/Span Check
Woodstove Data Sheet #15-1

Site: Myren Consulting, Colville, WA Date: 7/19/10 Analyte: CO_2

Source: Kuma U3 Run #: EPA H

Zero Cyl #: AA-9167 Conc. 00.0 % CO_2 Cyl Press: 2005 psi

Certified By: Oxarc Date: 5/11/09

Span Cyl #: SX-45410 Conc. 12.6 % CO_2 Cyl Press: 1600 psi

Certified By: Matheson Tri Gas Date: 4/12/10

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 Values= 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: 1117 Temp: 80 °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	.00655	+0.00655	+0.27
Span	50.0	.500	12.5	50.0	.500	12.3940	-0.2060	-1.64

Comments:

Post Run Audit: By: A.T. Myren Time: 1526 Temp: 84 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	00.0	.001	.00912	+0.00912	+0.36
Span	50.0	.500	12.5	50.0	.502	12.4433	-0.1567	-1.24

Comments:

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

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

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

Pre and Post Test Zero/Span Check
Woodstove Data Sheet # 15-3

Site: Myren Consulting, Colville, WA Date: 7/19/10 Analyte: CO

Source: KUMA U.3 Run #: 4

Zero Cyl #: AA-9167 Conc. 00.0 % CO Cyl Press: 2005 psi

Certified By: Oxarc Date: 5/11/09

Span Cyl #: SY-45410 Conc. 2.55 % CO Cyl Press: 1600 psi

Certified By: Matheson TRI GAS Date: 4/12/10

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

Range: 0 - 10.0% CO (0 – 5.0% CO) Analyzer Output: 0 – 1.0 v.

Flow: 1.5 SCFH Measured By: Rotameter: X Flowmeter: _____

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

Pre Run Audit: By: A.T. Myren Time: 1117 Temp: 80 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	0.000	.000	.00655	+0.00655	+0.27
Span	2.55	.255	2.55	2.56	.255	2.5004	-0.04964	-1.95

Comments:

Post Run Audit: By: A.T. Myren Time: 1526 Temp: 84 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	0.00	.001	.01694	+0.01694	+0.34
Span	2.55	.255	2.55	2.51	.251	2.4613	-0.00875	-3.48

Comments:

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

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

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

Unit: Kuma V.3
Run: EPA 4
Date: 7/19/10
Technicians: ATM JRP POG
WST6-Form3, Rev 12/09

Quality Checks
Woodstove Data Sheet #16

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

Thermocouple Check (at ambient): T/C # 1: — °F; T/C#2: 63.2 °F
T/C # 3: 60.0 °F; T/C # 4: 60.6 °F; T/C #5: 61.1 °F;
T/C # 6: 61.2 °F; T/C # 7: 61.1 °F; T/C # 8: 61.5 °F;
T/C # 9: 61.5 °F; T/C # 10: 61.5 °F; T/C # 11: 62.0 °F;
T/C # 12: 62.8 °F; T/C # 13: 62.7 °F; T/C # 14: 62.2 °F;
T/C # 15: 61.7 °F; T/C # 16: 66.0 °F; T/C # 17: 61.3 °F;
T/C # 18: 60.6 °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	Adj	Post Test Check	%Difference
(0°F): -0.1 °F	to: — °F	Zero (0°F): 0.9 °F	+0.20
Span	Adj	Span	
(2000°F): 2000.6 °F	to: — °F	(2000°F): 2003.5 °F	+0.14

(Allowable % Difference = 1.5%. Use Formulas on Woodstove Data Sheet #15 to calculate % Difference, % Difference calculated in degrees absolute.)

Thermocouple Readout Pretest Linearity Check

0°F = -0.0 °F; 200°F = 202.0 °F; 400°F = 399.5 °F
600°F = 601.7 °F; 800°F = 801.9 °F; 1000°F = 1001.0 °F
1200°F = 1198.7 °F; 1400°F = 1399.8 °F; 1600°F = 1600.3 °F
1800°F = 1800.6 °F; 2000°F = 2000.6 °F

Combustion Gas (CO_2, O_2, CO) Train Leak Check: Pre OK JRP Post OK JRP
Draft (Static) Guage Zero Check: Pre OK ATM Post OK JRP
Scale Check Pre (Wt, #'s): 547.9 - 542.9 = 5.0 lbs / 5.0 lbs = OK ATM
Post (Wt, #'s): 550.2 - 545.2 = 5.0 lbs / 5.0 lbs = OK ATM

Stack Cleaned Prior to the Run: Yes _____ No ✓
Tunnel Cleaned Prior to the Run: Yes _____ No ✓

EPA 3.10 HI

DILUTION TUNNEL CALCULATIONS

MYREN CONSULTING CERTIFICATION TEST DATA

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

File Name:	EPA 1
Manufacturer:	KUMA
Model Number:	V.3
Lab Name:	MYREN
Test Date:	7\13\10
Run Number:	EPA 1
Meter Box Y Factor:	1.0159
Barometric pressure (in):	28.32
Gas meter temp (ave):	**80**
delta H(avg):	**0.900**
Gas meter initial reading:	620.3000
Gas meter final reading:	677.8330
Front catch (acetone) mg:	5.38
first filter catch (mg):	23.6
second filter catch (mg):	1.9
Tunnel Flow (Qsd) (dscfm)	**148.593**
Emission Rate(g/hr):	**5.084**
Emission Rate(M5H) :	**7.018**
Avg. of Delta P Sq. Roots:	**0.2119**
Vs (Avg.)(ft/min):	**907.509**
Tunnel Avg. Temperature (F):	**114.917**
Test time(min):	110
Fuel Load(lb. wet):	9.822
Wood moisture(%wet):	17.395
Burn rate(dry kg/hr):	**2.007**
Sample Volume (dscf)	**54.156**
Avg. Tunnel Static (-Inch H2O):	**0.1808**
Room Blank Catch (mg/dscf):	0
Emission Factor (g/kg):	**2.5325**
Pitot Correction Factor:	0.98077
front filter number	111
back filter number	110
Beaker Number:	37
PRELIMINARY RESULTS	
FINAL RESULTS:	AUDITED

DATA SUMMARY

MODEL:	V.3
RUN:	EPA 1
DATE:	7\13\10
DBR:	2.007
EMISSION RATE (g/hr)(M5H)	7.0178
EMISSION FACTOR (g/kg):	2.5325
AVG. % PROPORTIONALITY :	99.697

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	112	620.3000	66	0.900	916.13			0.184	0.2145	
10	0.044	130	625.5100	69	0.900	909.97	106.4	5.010	0.179	0.2098	
20	0.045	132	630.6820	74	0.900	921.82	102.7	4.927	0.185	0.2121	
30	0.046	130	635.9180	76	0.900	930.43	101.9	4.969	0.184	0.2145	
40	0.046	122	641.1120	80	0.900	924.11	98.9	4.893	0.186	0.2145	
50	0.047	116	646.3430	82	0.900	929.27	97.3	4.910	0.187	0.2168	
60	0.043	113	651.5710	84	0.900	886.52	100.6	4.889	0.178	0.2074	
70	0.044	111	656.7920	85	0.900	895.20	98.8	4.873	0.176	0.2098	
80	0.044	106	662.0430	86	0.900	891.27	98.6	4.892	0.176	0.2098	
90	0.045	104	667.3030	87	0.900	899.75	97.1	4.892	0.179	0.2121	
100	0.045	102	672.5580	88	0.900	898.15	96.5	4.878	0.176	0.2121	
110	0.044	101	677.8330	88	0.900	887.33	97.9	4.897	0.180	0.2098	
120											
130											
140											
150											
160											
170											
180											
190											
200											
210											
220											
230											
240											
250											
260											
270											
280											
290											
300											
310											
320											
330											
340											
350											
360											
370											
380											

MYREN CONSULTING, INC.
6 Inch Dilution Tunnel Traverse Data

Unit: Kuma V.3
Run #: EPA1
Date: 7/13/10
Technicians: ATM, JRP PDG CSO
Rev 2/22/09

Point	Location	Δp	$\sqrt{\Delta p_{trav}}$	$\sqrt{\Delta p_{cent}}$	T_{trav}	T_{cent}	Pg
W-1	0.5"	.1040	.2000		118		
2	1.5	.1047	.2168		120		
Center	Center	.1045		.2121		121	-.1984
3	4.5	.1044	.2098		122		
4	5.5	.1043	.2074		122		
S-1	0.5	.1039	.1975		116		
2	1.5	.1044	.2098		116		
Center	Center	.1044		.2098		116	-.1983
3	4.5	.1045	.2121		115		
4	5.5	.1041	.2025		114		
	Totals		1.6559	.4219	943	237	-.367
	Average		.2070	.21095	117.9	118.5	-.1835
	°R = (°F + 460)				577.9	578.5	

BP: 28.315 in. Hg Ps = BP+(Pg/13.6) = 28.315 + (-.1835/13.6) = 28.302 in. Hg

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

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

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

UNIT: Kuma V.3 DATE: 7/13/10 RUN #: EPA 1 TECHNICIAN(S): ATM

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) (.2070 x $\sqrt{\Delta P}$ "H_2O) $\sqrt{\frac{5779 \text{ Ts °A}}{\{0\}}}$ = 14.81356 fps

{2} {2} (28.302 Ps "Hg) (28.56 lb./ lb. mole) {2}

{2}

(9A) Vs = (14.8136 fps) (60) = 888.8138 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) (.2095 x $\sqrt{\Delta P}$ "H_2O) $\sqrt{\frac{5781.5 \text{ Ts °A}}{\{0\}}}$ = 15.10407 fps

{2} {2} (28.302 Ps "Hg) (28.56 lb./ lb. mole) {2}

{2}

(9A) Vs = (15.10407 fps) (60) = 906.2443 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 = 14.81356 ÷ 15.10407 = 0.98077

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) (14.81356 fps) (.1963 ft²) [(528 °A) (28.302 Ps "Hg) / (5779 T_s °A) (29.92" Hg) =

{2} {3} {2} {0}

8,685.408 dscfhr (or dscfh)

{1}

(10A) 8685.408 dscfhr ÷ 60 = 144.757 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.

M5G-1

Unit: Kuma V.2
Run: EPA 1
Date: 7/13/10
Page 1 of 1 Rev 5/10

Method 5G Particulate Sampling Data

Meter Box 45G-P Meter Y 1.0159 Filter #'s: (F) 111 (R) 110

Filter/O-Ring ID #: —

.089/.0895
Pre Test Leak Check: .0005 CFM@ -15.2 in Hg Filter Size: 110 mm

Probe ID #: —

.9845/.9845
Post Test Leak Check: .000 CFM@ -15.25 in Hg Probe Length 21.5 in

Time		Meter Reading (ft³)	Pitot		Tunnel Temp (°F)	Meter Temp (°F)	Gas Meter Δh	Vac (in Hg)
Clock	Elapsed		ΔP	Pg				
1248	00	620.300	.046	-.184	112	66	0.90	0
58	10	625.510	.044	-.179	130	69	.90	0
1308	20	630.682	.045	-.185	132	74	.90	0
18	30	635.918	.046	-.184	130	76	.90	0
28	40	641.112	.046	-.186	122	80	.90	0
38	50	646.343	.047	-.187	116	82	.90	0
48	60	651.571	.043	-.178	113	84	.90	0
58	70	656.792	.044	-.176	111	85	.90	0
1408	80	662.043	.044	-.176	106	86	.90	0
18	90	667.303	.045	-.179	104	87	.90	0
28	100	672.558	.045	-.176	102	88	.90	0
38	110	677.833	.044	-.180	101	88	.90	0
	120							
	130							
	140							
	150							
	160							
	170							
	180							
	190							

BP

00	28.32		
60	28.32		
110	28.32		
		Avg. =	28.32

Pre Test Filter Check Weighing
F .6510
R .6528

.6746 .6549
End of Test Weight

F	R
.6759	.6568
.6510	.6530
.0249	.0039

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

Into Dessicator: Date 11/20/09 Time 1026 By PDQ Front Half ✓ Back Half ✓

Manufacturer: Pall P/N 60115 Size: 110 mm Lot.No.: T72680 Grade: A/E GLASS

Filter #	First Wt	2010 Date	Time	By	Second Wt	2010 Date	Time	By	Third Wt	Date	Time	By
101	.6559	1121	1103	PDQ	.6559	7/6	1802	ATM				
102	.6532		1104	PDQ	.6533		1800	ATM				
103	.6552		1105	PDQ	.6551		1801	ATM				
104	.6545		1106	PDQ	.6545		1800	ATM				
105	.6556		1107	PDQ	.6555		1759	ATM				
106	.6545		1108	PDQ	.6546		1758	ATM				
107	.6546		1109	PDQ	.6547		1757	ATM				
108	.6522		1110	PDQ	.6524		1756	ATM				
109	.6558		1111	PDQ	.6557		1755	ATM				
110	.6531		1112	PDQ	.6530		1754	ATM				
111	.6511		1113	PDQ	.6510		1753	ATM				
112	.6538		1114	PDQ	.6537		1752	ATM				
113	.6553		1115	PDQ	.6553		1751	ATM				
114	.6548		1115	PDQ	.6550		1750	ATM				
115	.6533		1116	PDQ	.6536		1749	ATM				
116	.6580		1117	PDQ	.6579		1748	ATM				
117	.6543		1118	PDQ	.6545		1747	ATM				
118	.6564		1119	PDQ	.6564		1747	ATM				
119	.6564		1120	PDQ	.6562		1746	ATM				
120	.6548		1121	PDQ	.6549		1745	ATM				
121	.6526		1122	PDQ	.6527		1744	ATM				
122	.6565		1123	PDQ	.6564		1743	ATM				
123	.6567		1124	PDQ	.6568		1743	ATM				
124	.6560		1125	PDQ	.6552		1742	ATM				
125	.6528	—	1126	PDQ	.6528	✓	1741	ATM				

Checked by ATM MW Date: 7/6/10 Time 1805

QA REWEIGH

Filter #	WT	Date	Time	By
106	.6545	7/7/10	0657	
115	.6533	7/7/10	0658	
101	.6525	7/7/10	0659	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	Date	Time	By
56	72	34	1121	0952	PDQ
58	70	48	7/6/2010	1630	ATM
58	70	48	7/7/10	0645	ATM

POST 1121 7/6 7/16

0.0000 0.0000 0.0000

96.9447

Woodstove Data Sheet #4-2: Initial Beaker Weights (Tare Weights)

Scale 2

Into Dessicator: Date 4 May 10 Time 0940 By ATM

Balance Used: Sartorius Model: CP224S SN: [redacted]

Beaker #	First Wt	Date	Time	By	Second Wt	2010 Date	Time	By	Third Wt	Date	Time	By
20	3171	5/5	1453	ATM	73.3176	5/7	1641					
8	71 .0018		1504	ATM	71.0022	5/7	1704		71.0018	5/8/10	1245	ATM
22	71 .8331		1503	ATM	71.8344	5/7	1705		71.8337	5/8/10	1246	ATM
23	70. 7386		1455	ATM	70.7392	5/7	1708		70.7385	5/8/10	1227	ATM
24	73. 2178		1456	ATM	73.2187	5/7	1700		73.2187	5/8/10	1229	ATM
25	72 .6512		1459	ATM	72.6516	5/7	1650		72.6511	5/11/10	1447	ATM
26	71. 7872		1507	ATM	71.7879	5/7	1647		71.7875	5/11/10	1438	ATM
27	72 .3304		1508	ATM	72.3311	5/7	1657		72.3305	5/8/10	1243	ATM
29	71 .5185		1510	ATM	71.5198	5/7	1656		71.5193	5/11/10	1543	ATM
30	70 .8552		1511	ATM	70.7856	5/7	1658		70.7855	5/11/10	1641	ATM
32	53. 5986		1506	ATM	53.5999	5/7	1702		53.5996	5/8/10	1235	ATM
33	53 .1475		1505	ATM	53.1488	5/7	1701		53.1484	5/11/10	1437	ATM
36	53 .5736		1501	ATM	53.5747	5/7	1707		53.5742	5/8/10	1238	ATM
38	53 .2513		1500	ATM	53.2523	5/7	1703		53.2520	5/8/10	1239	ATM
40	53. 4617		1457	ATM	53.4625	5/7	1706		53.4624	5/8/10	1236	ATM
41	52. 8355		1458	ATM	52.8364	5/7	1707		52.8368	5/8/10	1239	ATM
43	53 .2319	↓	1440	ATM	53.2323	5/7	1640					
31	69.6666	5/7/10	1655		69.6666	5/11	1445	ATM				
37	63.7263	5/7/10	1646		63.7259	5/11	1440	ATM				
(cont.)												
22	71.8338	5/11/10	1623									
27	72.3287	5/11/10	1622		72.3305	5/12/10	1500	ATM	72.3304	6/2/10	1620	

Run

blank

Checked by ATM Date: 6/2/10 Time: 1610

QA Reweigh

Beaker #	WT	Date	Time	By
22	71.8338	6/2/10	1617	ATM
32	53.5997	6/2/10	1619	
21	71.1003	6/2/10	1620	

Balance Room Environmental Conditions

WB 61	DB 75	%RH 44	Date 5/5	Time N16	By ATM
59	73	42	5/7/10	1600	ATM
59	71	48	5/8/10	1140	ATM
55	69	42	5/11/10	1349	ATM
60	73	46	5/12/10	1314	ATM
61	75	44	6/2/10	1602	ATM

Post Weighing	Date	1st	2nd	3rd	4th	5th	6th
	0.0000g	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Scale Check	100.0000g	99.9996	99.9995	99.9995	99.9995	99.9995	99.9995

M56-1, Trouw

Unit Kum. V.3

Woodstove Data Sheet #4-3: Constant Final Weights

Run # EPA 1

Date: 7/13/10

60 ml 53.7246

WST5-Form 9, Pg 1, Rev 5/10

Final Beaker Weights

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
37	53.7333	7/16	1015	ATM	53.7330	7/17	1854	ATM	53.73396	7/18	2101	JM	53.7319	7/19	1101	ATM
					53.7324	7/20	2140	JM	53.7320	7/26	2210	ATM	53.7318	7/27	2027	ATM
					53.7316	7/2	1425	JM	53.7314	7/29	1348	ATM				

Final Filter Weights

2010

	Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
F	111	.6759	7/13	1515	ATM	.6752	7/14	1457	ATM	.6759	7.15	1530	JRP	.6748	7/16	1831	JM
					.6746	7/8	2103	JM								
R	110	.6568	7/13	1515	ATM	.6553	7/14	1456	ATM	.6549	7.15	1529	JRP				

QA Reweigh: Final Weight

Date	Beaker #	Final Wt	By

Date	Filter #	Final Wt	By

Scale Room Environmental Conditions

Weighing Session	2010 Date	Time	By	WB	DB	%RH
1	7/13	N/A				
2	7/14	1444	ATM	58	70	48
3	7.15	1228	ATM	60	73	46
4	7/16	1810	ATM	61	75	44
5	7/17	1800	ATM	60	73	46
6	7/18	2015	ATM	61	74	47

Scale Room Environmental Conditions

7	7/19	1040	ATM	60	73	46
8	7/20	1350	ATM	59	72	45
9	7/22	1617	ATM	61	74	46
10	7/26	2141	ATM	62	76	45
11	7/27	2206	ATM	63	76	49
Comments	7/28	1340	ATM	64	77	49
	7/29	1330	ATM	64	77	49

Acetone Blank 7/13/10
BKR 29 50ml Acetone
lot #074092 Tare Wt. 71.5193

Kuma

Unit Kuma-V.C
Run # ERA-1
Date: 7/13/10

Woodstove Data Sheet #4-3: Constant Final Weights

WST5-Form 9, Pg 1, Rev 5/10

Final Beaker Weights

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
29	71.5194	7/30	1546	AM	71.5180	7/31	1111	ATM	71.5195	7/31	2028	JC	71.5194	8/1	0941	ATM

Final Filter Weights

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

QA Reweigh: Final Weight

Date	Beaker #	Final Wt	By

Date	Filter #	Final Wt	By

Scale Room Environmental Conditions

Weighing Session	20 to Date	Time	By	WB	DB	%RH
1	7/31	1020	ATM	58	72	42
2	7/31	2005	ATM	64	77	49
3	8/1	0936	ATM	64	77	49
4						
5						
6						

Scale Room Environmental Conditions

7					
8					
9					
10					
11					

Comments

Woodstove Data Sheet 4-4 Scale QC Record Sheet

Scale 1

From: 7/20/10
Through:

Scale: Sartorius
Model: CP224S
SN: 17050374
Rev: 3/10

* 135.0000 g = 100.0000 + 20.0000 + 10.0000 + 5.0000 wts, 100g wt = 99.9991 - 90

Level	Recalibrated	130g * Weights	100g Weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	2010 Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9988	99.9989	9.9999	1.0000	0.1000	0.0199	7/20	1350	ATM	28.36	59	72	45	118
Yes	Yes	134.9988	99.9989	9.9999	0.9999	0.0999	0.0199	7/21	1715	ATM	28.22	63	77	45	117
Yes	No	134.9988	99.9989	10.0000	1.0000	0.1000	0.0199	7/22	1617	ATM	28.16	61	74	46	119
Yes	Yes	134.9989	99.9990	9.9999	1.0000	0.0999	0.0199	7/26	2141	ATM	28.15	62	76	45	120
Yes	No	134.9990	99.9991	9.9999	1.0000	0.0999	0.0199	7/27	2006	ATM	28.32	63	76	49	118
Yes	No	134.9991	99.9992	9.9999	1.0000	0.1000	0.0199	7/28	1340	ATM	28.34	64	77	49	116
Yes	No	134.9989	99.9990	9.9999	1.0001	0.1001	0.0200	7/29	1330	ATM	28.41	64	77	49	115
Yes	No	134.9990	99.9991	9.9999	1.0000	0.1000	0.0199	7/30	1639	ATM	28.25	64	77	49	116
Yes	No	134.9989	99.9989	9.9999	0.9999	0.0999	0.0199	7/31	1020	ATM	28.29	58	72	42	116
Yes	No	134.9990	99.9991	9.9999	1.0000	0.1000	0.0199	7/31	2005	ATM	28.22	64	77	49	119
Yes	Yes	134.9988	99.9989	9.9999	0.9999	0.1000	0.0199	8/1	0926	ATM	28.32	56	68	46	116
Yes	No	134.9988	99.9989	9.9999	1.0001	0.0999	0.0199	8/1	2050	ATM	2830	61	74	47	117
Yes	Yes	134.9988	99.9989	9.9999	1.0001	0.1000	0.0199	8/2	0756	ATM	28.40	58	70	48	117
Yes	Yes	134.9988	99.9989	9.9999	1.0000	0.1001	0.0199	8/3	1600	JRP	28.34	58	70	48	116

Woodstove Data Sheet 4-4 Scale QC Record Sheet All Scales and Desiccators Individually Grounded Now.

From: 5/31/10
Through: 7/19/10

Scale: Sartorius
Model: CP224S
SN: 17050374
Rev: 3/10

Scale 1 Scale 2

* 135.0000g = 100.0000 + 20.0000 + 10.0000 + 5.0000 wts. 100g wt = 99.9991-99.9990

Level	Recalibrated	135g * Weights	100g Weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9992	99.9992	9.9999	1.0001	0.1001	0.0200	5/31/10	10:45	ATM	28.21	58	70	48	120
Yes	No	134.9992	99.9993	10.0000	1.0001	0.1001	0.0200	6/1/10	14:45	ATM	28.22	57.5	70	46	119
Yes	Yes	134.9990	99.9990	9.9999	1.0001	0.1000	0.0199	6/2/10	1602	ATM	28.09	61	75	46	118
Yes	Yes	134.9989	99.9989	9.9999	0.9999	0.1000	0.0201	6/3/10	1450	ATM	28.20	57	69	46	120
Yes	No	134.9991	99.9991	9.9999	1.0000	0.1001	0.0199	6/4/10	0950	ATM	28.09	55	68	42	120
Yes	No	134.9989	99.9990	9.9999	0.9999	0.1000	0.0199	6/7/10	1350	ATM	28.40	60	72	49	119
Yes	No	134.9989	99.9990	9.9999	1.0000	0.1000	0.0199	6/10/10	1545	ATM	28.395	58	70	48	121
Yes	No	134.9990	99.9990	9.9999	1.0000	0.1000	0.0199	6/11/10	1440	ATM	28.57	61	74	46	120
Yes	No	134.9990	99.9991	9.9999	1.0000	0.1001	0.0200	6/13/10	2035	ATM	28.33	58	71	44	120
Yes	No	134.9991	99.9990	10.0000	1.0001	0.1001	0.0199	6/15/10	1438	ATM	28.28	59	72	45	120
Yes	No	134.9990	99.9990	10.0000	0.9999	0.1000	0.0199	6/22/10	2041	ATM	28.45	58	70	48	121
Yes	No	134.9993	99.9993	10.0000	1.0000	0.1000	0.0199	6/23/10	2230	ATM	28.45	64	77	48	118
Yes	Yes	134.9989	99.9989	9.9999	0.9999	0.1000	0.0199	6/27/10	1710	ATM	28.09	60	74	43	117
Yes	Yes	134.9989	99.9989	9.9999	0.9999	0.0999	0.0199	6/29/10	1407	ATM	28.20	61	74	47	119
Yes	Yes	134.9989	99.9989	9.9999	1.0001	0.1001	0.0199	7/5/10	1705	ATM	28.38	58	70	48	118
YES	Yes	134.9988	99.9987	9.9999	0.9999	0.1000	0.0199	7/6/10	1250	JRP	28.48	57	68	50	118
Yes	Yes	134.9988	99.9989	9.9999	1.0000	0.1000	0.0199	7/6/10	1630	ATM	28.52	58	70	48	121
Yes	Yes	134.9988	99.9989	9.9999	1.0000	0.0999	0.0199	7/7/10	0645	ATM	28.52	58	70	48	120
Yes	No	134.9992	99.9992	9.9999	1.0000	0.1000	0.0199	7/8/10	1409	ATM	28.43	64	77	49	117
Yes	No	134.9991	99.9992	9.9999	1.0000	0.1000	0.0199	7/10/10	2145	ATM	28.04	61	74	46	119
Yes	No	134.9991	99.9992	9.9999	1.0000	0.1000	0.0195	7/12/10	1109	ATM	27.95	60	72	48	119
Yes	Yes	134.9988	99.9989	9.9999	1.0000	0.1000	0.0199	7/13/10	1426	ATM	28.35	55	67	45	119
Yes	No	134.9988	99.9989	9.9999	1.0001	0.1001	0.0200	7/14/10	1444	ATM	28.48	58	70	48	117
Yes	No	134.9988	99.9989	9.9999	1.0000	0.1000	0.0199	7/15/10	1128	ATM	28.43	60	73	46	115
Yes	No	134.9989	99.9990	9.9999	0.9999	0.1000	0.0199	7/16/10	1810	ATM	28.28	61	75	44	117
Yes	No	134.9989	99.9990	9.9999	0.9999	0.0999	0.0199	7/17/10	1800	ATM	28.29	60	73	46	120
Yes	No	134.9991	99.9991	10.0000	1.0000	0.1000	0.0199	7/18/10	2015	ATM	28.25	61	74	47	121
Yes	No	134.9989	99.9990	9.9999	1.0000	0.1000	0.0199	7/19/10	1040	ATM	28.40	60	73	46	119

WOODSTOVE DATA SHEET 4-4 SCALE QC RECORD SHEET

Scale 1

FROM: 01/19/2010 - 0739

THROUGH: 2/21/10

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	2010 Date	Time	Tech	Wet Bulb	Dry Bulb	% RH
Yes	*Yes	139.9992	99.9993	9.9999	1.0000	0.1000	0.0199	1/19	0739	PDQ	57	73	35
Yes	Yes	139.9991	99.9994	9.9999	1.0000	0.1000	0.0199	1/20	1427	JRP	57	70	41
Yes	Yes	139.9991	99.9992	9.9999	1.0000	0.1000	0.0199	1/21	0952	PDQ	56	72	34
Yes	NO	139.9992	99.9993	9.9999	1.0000	0.1000	0.0199	1/22	0719	JRP	55	69	39
Yes	Yes	139.9991	99.9992	9.9999	1.0000	0.1000	0.0199	1/25	1345	PDQ	55	69	39
Yes	No	139.9991	99.9992	9.9999	1.0000	0.1000	0.0199	1/27	1345	ATM	59	74	40
Yes	No	139.9993	99.9994	10.0000	1.0001	0.1001	0.0200	1/30	0600	ATM	58	70	48
Yes	No	139.9993	99.9993	10.0000	1.0000	0.1000	0.0199	1/30	1121	PDQ	58	74	36
Yes	No	139.9993	99.9994	9.9999	1.0000	0.1000	0.0199	1/31	1530	ATM	59	74	40
Yes	No	139.9992	99.9993	10.0000	1.0000	0.1000	0.0199	2/1	1055	ATM	57	70	41
Yes	No	139.9992	99.9993	9.9999	1.0000	0.1000	0.0199	2/2	1755	ATM	57	71	41
Yes	Yes	139.9991	99.9992	9.9999	1.0000	0.1000	0.0200	2/3	0521	ATM	59	72	43
Yes	No	139.9991	99.9992	10.0000	1.0001	0.1000	0.0199	2/3	1913	ATM	56	68	46
Yes	Yes	139.9991	99.9992	9.9999	1.0001	0.1001	0.0199	2/4	0514	ATM	60	74	43
Yes	Yes	139.9992	99.9993	9.9999	1.0000	0.1000	0.0199	2/5	0547	ATM	59	74	40
Yes	Yes	139.9991	99.9992	9.9999	0.9999	0.1000	0.0199	2/5	1940	ATM	57	69	47
Yes	No	139.9992	99.9993	10.0000	1.0001	0.1001	0.0199	2/6	1925	ATM	57	70	41
Yes	No	139.9992	99.9993	10.0000	1.0001	0.1001	0.0200	2/7	0755	ATM	57	70	41
Yes	Yes	139.9992	99.9992	10.0000	1.0001	0.1001	0.0200	2/8	0810	ATM	56	71	37
Yes	Yes	139.9992	99.9992	9.9999	1.0000	0.1001	0.0200	2/8	2110	ATM	56	69	43
Yes	Yes(*)	134.9992	99.9992	9.9999	0.9999	0.1000	0.0199	2/9	1936	ATM	57	70	41
Yes	Yes	134.9992	99.9992	9.9999	1.0001	0.1001	0.0199	2/10	0530	ATM	54	66	44
Yes	NO	134.9992	99.9992	10.0000	1.0001	0.1001	0.0199	2/10	1935	ATM	55	67	45
Yes	NO	134.9992	99.9992	9.9999	1.0000	0.1000	0.0199	2/11	1553	ATM	56	69	43
Yes	No	134.9993	99.9993	9.9999	1.0001	0.1001	0.0199	2/12	1910	ATM	53	64	46
Yes	No	134.9992	99.9992	10.0000	1.0001	0.1000	0.0199	2/13	1745	ATM	55	66	48
Yes	No	134.9992	99.9992	10.0000	1.0000	0.1000	0.0199	2/14	1905	ATM	55	66	48
Yes	No	134.9992	99.9992	10.0000	1.0000	0.1001	0.0199	2/15	1500	ATM	57	69	47
Yes	Yes	134.9991	99.9992	10.0000	1.0000	0.1000	0.0200	2/16	1409	ATM	55	67	45
Yes	No	134.9994	99.9993	10.0000	1.0000	0.1000	0.0199	2/18	1935	ATM	58	70	48
Yes	No	134.9992	99.9992	9.9999	1.0001	0.1001	0.0199	2/19	1704	ATM	56	69	43
Yes	No	134.9992	99.9992	9.9999	1.0000	0.1001	0.0200	2/20	1305	ATM	54	68	38
Yes	No	134.9993	99.9994	9.9999	1.0001	0.1000	0.0199	2/21	1541	ATM	56	68	46

* Switched to 20 mg wt. weighing 100, 20, 10 & 5 together for 135.0010

Woodstove Data Sheet 4-4 Scale QC Record Sheet
Scale 2

From: 7/27/10
Through: _____

Scale: Sartorius
Model: CPA 2245
SN: 24850860
Rev: 5/10

2010

Level	Recalibrated	135g Weights	100g Weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9996	99.9995	9.9999	1.0000	0.1000	0.0200	7/27/10	2200	ATM	28.32	63	76	49	110
Yes	Yes	134.9994	99.9994	9.9999	0.9999	0.1000	0.0199	7/28/10	1340	ATM	28.34	64	77	49	110
Yes	No	134.9996	99.9996	9.9999	1.0000	0.1000	0.0199	7/29	1330	ATM	28.41	64	77	49	115
Yes	NO	134.9995	99.9995	9.9999	1.0000	0.0999	0.0199	7/30	1639	ATM	28.25	64	77	49	111
Yes	No	134.9994	99.9994	9.9999	0.9999	0.0999	0.0199	7/31	1020	ATM	28.29	58	72	42	114
Yes	No	134.9995	99.9994	9.9999	1.0000	0.1000	0.0199	7/31	2005	ATM	28.22	64	77	49	119
Yes	No	134.9996	99.9994	9.9999	0.9999	0.0999	0.0199	8/1	0926	ATM	28.32	56	68	46	116
Yes	No	134.9996	99.9994	9.9999	1.0000	0.1000	0.0199	8/1	2050	ATM	28.30	61	74	47	117
Yes	Yes	134.9995	99.9994	9.9999	0.9999	0.0999	0.0199	8/2	0759	ATM	28.40	58	70	48	117
yes	no	134.9994	99.9994	9.9999	1.0000	0.1000	0.0199	8/2	12:50	SEK	28.37	61	75	46	118
Yes	NO	134.9994	99.9994	9.9999	0.9999	0.1000	0.0199	8/3	1600	JRP	28.34	58	70	48	116
yes	no	134.9996	99.9995	9.9999	1.0000	0.1000	0.0199	8/4	10:20	SEK	28.43	54	66	44	118
Yes	NO	134.9994	99.9994	9.9999	1.0000	0.0999	0.0199	8/5	1000	JRP	28.33	56	67	49	119
yes	NO	134.9996	99.9994	10.0000	1.0000	0.1001	0.0199	8/6	11:24	SEK	28.21	58	72	41	119
Yes	YES	134.9995	99.9995	9.9999	0.9999	0.0999	0.0199	8/8	1446	JRP	28.21	60	73	46	118
Yes	NO	134.9995	99.9994	9.9999	0.9999	0.1000	0.0199	8/12	16:43	SEK	28.18	56	68	46	117
Yes	NO	134.9994	99.9995	9.9999	0.9999	0.0999	0.0199	8/14	1457	JRP	28.47	58	70	48	116
Yes	No	134.9995	99.9995	9.9999	1.0000	0.1000	0.0199	8/16	0743	ATM	28.41	56	68	46	119

Woodstove Data Sheet 4-4 Scale QC Record Sheet

Scale 2 ~~Scale 2~~

From: 4/6/10
Through: 7/21/10

Scale: Sartorius
Model: CPA 2245
SN: 24850860
Rev: 5/10

* 135.0000 g = 100.0000 + 20.0000 + 10.0000 + 5.0000 2010

Level	Recalibrated	135g * Weights	100g Weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9998	99.9997	9.9999	1.0000	0.0999	0.0199	4/6	1601	ATM		60	75	40	
Yes	No	134.9994	99.9994	9.9999	1.0001	0.1001	0.0199	4/13	0945	ATM		57	70	44	
Yes	No	134.9996	99.9996	10.0000	1.0001	0.1001	0.0199	4/13	1338	ATM		60	72	48	
Yes	Yes	134.9993	99.9993	9.9998	0.9999	0.0999	0.0199	4/14	1445	JRP		59	71	48	
Yes	Yes	134.9994	99.9994	9.9998	0.9999	0.0999	0.0198	4/15	1048	PDB	28.43	58	72	42	
Yes	No	134.9996	99.9994	9.9999	1.0000	0.1000	0.0200	4/22	1455	ATM	28.13	62	75	47	
Yes	No	134.9996	99.9996	9.9999	1.0000	0.1000	0.0199	5/5	1100	ATM	28.43	61	75	44	117
Yes	No	134.9996	99.9995	9.9999	0.9999	0.1000	0.0199	5/7	1600	ATM		59	73	42	122
Yes	No	134.9996	99.9995	9.9999	1.0000	0.0999	0.0200	5/8	1140	ATM	28.28	59	71	48	120
Yes	No	134.9995	99.9994	9.9999	1.0000	0.1000	0.0199	5/11	1349	ATM	28.39	55	68	42	119
Yes	No	134.9995	99.9994	9.9999	0.9999	0.1000	0.0199	5/12	1314	ATM	28.34	60	73	46	120
Yes	No	134.9996	99.9995	9.9999	1.0000	0.1000	0.0199	5/13	1340	ATM	28.37	62	75	47	119
Yes	No	134.9996	99.9995	10.0000	1.0001	0.1001	0.0200	5/14	0630	ATM	28.31	58	71	44	120
Yes	Yes	134.9996	99.9994	9.9998	0.9999	0.1000	0.0199	6/2	1602	ATM	28.09	61	75	46	118
Yes	No	134.9996	99.9995	9.9999	1.0000	0.1000	0.0199	6/22	2041	ATM	28.45	58	70	48	121
Yes	Yes	134.9995	99.9994	9.9999	1.0000	0.1000	0.0199	6/23	1710	ATM	28.29	60	74	43	117
Yes	No	134.9994	99.9994	9.9999	1.0000	0.1000	0.0199	6/29/10	1407	ATM	28.20	61	74	47	119
Yes	No	134.9993	99.9993	9.9998	1.0000	0.1000	0.0198	7/14/10	1040	PDB	28.41	62	75	48	118
Yes	No	134.9997	99.9996	9.9999	1.0000	0.1000	0.0199	7/15/10	1128	ATM	28.43	60	73	46	118
Yes	No	134.9996	99.9995	9.9999	1.0000	0.1000	0.0199	7/16/10	1810	ATM	28.28	61	75	44	117
Yes	No	134.9997	99.9996	9.9999	0.9999	0.0999	0.0199	7/17/10	1800	ATM	28.29	60	73	46	120
Yes	No	134.9996	99.9994	9.9999	1.0000	0.0999	0.0199	7/18/10	2015	ATM	28.25	61	74	47	120
Yes	No	134.9996	99.9995	9.9999	0.9999	0.1000	0.0199	7/19/10	1040	ATM	28.40	60	73	46	119
Yes	No	134.9996	99.9994	10.0000	1.0000	0.1000	0.0199	7/20/10	1810	ATM	28.36	62	76	47	118
Yes	No	134.9996	99.9995	9.9999	0.9999	0.0999	0.0199	7/20/10	1350	ATM	28.36	59	72	45	118
Yes	Yes	134.9995	99.9994	9.9999	1.0001	0.1001	0.0199	7/21/10	1715	ATM	28.22	63	77	45	117
Yes	No	134.9996	99.9994	9.9999	0.9999	0.0999	0.0199	7/22/10	1617	ATM	28.16	61	74	46	119
Yes	Yes	134.9994	99.9994	9.9999	0.9999	0.0999	0.0199	7/21/10	2141	ATM	28.15	62	76	45	120

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

Unit: Euma V.3
Run: EPA
Date: 7/13/10
Technicians: ATM JRA PDG LJM
Revised 12/09-Data Sheet #5

Filters

Filter # (front) 111 | Beaker # 37 | Final Wt. 53.7314 g
Final Wt. .6746 g | Ml 60 | Tare Wt. 53.7259 g
Tare Wt. .6510 g | Desc. Acetone | Net Wt. .0055 g
Net Wt. .0236 g

Filter #(Rear) 110 | Beaker # _____ | Final Wt. _____ g
Final Wt. .6549 g | Ml _____ | Tare Wt. _____ g
Tare Wt. .6530 g | Desc. _____ | Net Wt. _____ g
Net Wt. .0019 g

Acetone Blank Calculation: Blank Date: 7/13/10

Blank Beaker # 29 | Final Wt. 71.5194 g
Ml 50 | Tare Wt. 71.5193 g
Desc. Acetone | Net Wt. .0001 g

.0001 g/ 50 ml = .000002 g/ml

Blank Residue Value Calculation:

.000002 g/ml acetone X 60 ml acetone = .00012 g
Blank Residue Value

Total Particulate Catch Calculation:

Filter: .0236 g
Filter: .0019 g
Beakers: .0055 g - .00012 g = .00538 g
Total Catch — Blank Residue Value

Total Catch = .03088 g
30.88 mg

Unit: Kuma V.3
Run # EPA 1
Date: 7/13/10
Technician: AM PDG JRP
WST6-Form1, Rev 5/10

Miscellaneous Test Data
Woodstove Data Sheet #8

Useable Firebox Dimensions: See QC Section Useable Volume: 1.554 ft³

Dilution Tunnel Draft (If Applicable): Start: 0.000 Stop: 0.000 Avg: 0.000 in. H_2O

Test Chamber Air Velocity: 10 Start: 12 Stop: _____ Avg: 11 ft./m.

Wet Bulb/ Start: WB: 56 °F DB: 69 °F % Amb Moisture: 1.10 %RH: 41

Dry Bulb Stop: WB: 57 °F DB: 70 °F % Amb Moisture: 1.10 %RH: 44

X Ambient Moisture(%Vol.) = 1.10 % X Relative Humidty (%RH) = 42.5 %

Empty Stove Wt: 329.1 lbs.

Empty Stove Wt with Stack (inc oil seal) Wet: 541.8 lbs. Dry: 542.0 lbs.

Empty Stove Wt with Stack and Ash Ash: — lbs. Total: 542.0 lbs.

Kindling Wt. Paper: 0.2 lbs. Wood: 3.2 lbs. Total: 3.4 lbs.

Pre Burn Fuel Wt. 10.668 + 7.928 + 9.278 Total: 27.874 lbs.

Total Kindling and Pre Burn Fuel Wt. 31.274 lbs.

Coal Bed Wt-lbs: Range(2.4 - 2.0) 544.4 - 544.0 lbs. Actual: 2.2 lbs.
544.2

Allowable Amount of Charcoal That Can Be Removed:

Coal Bed Wt. Range (2.4 (Upper Wt.) + 2.0 (Lower Wt.) /2) .25 = 0.500 lbs.

Test Fuel Wt-lbs: Ideal 10.9 lbs. Range: 11.9 - 9.8 lbs. Actual: 9.822 lbs.

Test Fuel Size (pcs.) (.75 x 1.5 x 5" Flanges): 14 Pcs. 1.478 lbs.

2 x 4's x 13.875 " 2 Pcs. 6.166 lbs. 62.777 %

4 x 4's x 13.875 " 1 Pcs. 3.656 lbs. 37.223 %

Est. Dry Burn Rate(Kg/Hr.) 9.822 - (9.822 x .17395) X 60/110 = 2.0074
3.6802
2.2046
Dry Burn Rate (Kg/Hr)

Est EPA Heat Output (HO_E)(Avg BTU's/Hr)(19,140) X 1.3 x 2.0074 = 24,206

100 EPA Heat Output (HO_E)BTU's/Hr

Stove Operating Data
Woodstove Test Data Sheet #9
Cold Start - High Burn

Unit: Ikuma V.3
Run: EPA 1
Date: 7/13/10
Technician(s): ATM JZP PDG
Data Sheet #9 - Rev 1/98-Pg.5

Fire Started: 10:01

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 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 11 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 HI at 5:00 minutes into the test, ON/OFF for the rest of the test.

Test Run Anomalies: None.

Unit Kuma V.3
Run # EPA 1
Date 7/13/10
Technician ATM JRP PDG SBK CO
Page 1 of 3
WST7-Form2-A, Rev 12/09

Woodstove Operating Data
Woodstove Data Sheet # 9A-1

Wood Data: Kindling: A mix of the below grades

	Size	Mill	Grade	Species
Pre Burn	2X4	Manke Tacoma	Std & BTR, #2	D. Fir Std Grn
Test Fuel	2X4	Manke Tacoma	#2, Std & BTR	D. Fir Std Grn
	4X4	"	"	#1, Std & BTR D. Fir Std Grn

All grades WCLB Rules Unless otherwise noted

Warm Up Information:
1st Warm Up/Pre Burn Fuel Charge (10.668 lbs) added at 10:15.
2nd Warm Up Pre Burn Fuel Charge (7.928 lbs) added at 11:05.
3rd Warm Up/Pre Burn Fuel Charge (9.278 lbs) added at 11:46.
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 .

The coals were scooped out of the stove immediately prior to adding the Third pre burn/warm up fuel charge. The stove lost 0.2 lbs. gained 1.5 lbs of hot coals were put back in the stove.

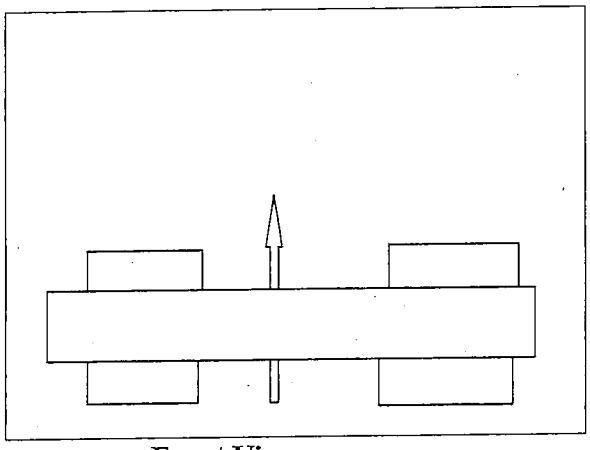
All pre burn/warm up fuel pieces were either 12 or 16 inches long. All pre burn pieces/fuel charges were "ricked" in the stove. The pieces in the bottom layer in each rick contained 2 pieces that were 12 inches long and were loaded flat and perpendicular to the door. The pieces in the second layer in each rick were loaded on their side (edge) approximately parallel to the door and contained 4 pieces 12 inches long. The third layer (and fourth layer if present) was loaded flat, perpendicular to the door and contained 2 pieces 12 inches long. The majority of the pieces in each rick were in the second layer. (The loading directions indicate the direction of the longest dimension on each piece relative to the loading door opening.)

Unit Kuma V.3
Run # EPA 1
Date 7/13/10
Technician AM JRG POC-CO SEK
Page 2 of 3
WST7-Form 2A, Rev 12/09

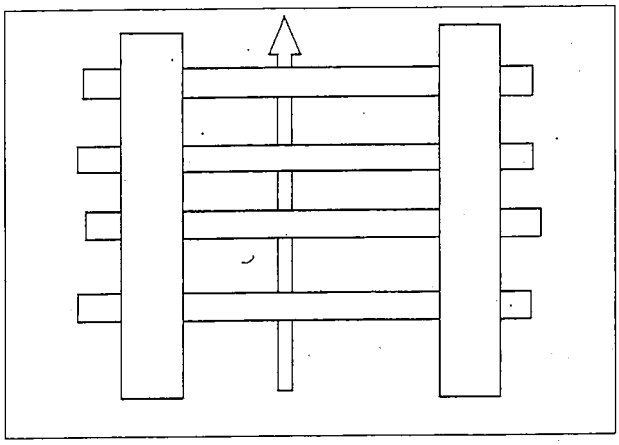
Wood Stove Operating Data
Wood Stove Data Sheet #9A-2

Warm Up Information (cont.):

Each warm up/preburn fuel charge was ricked in exactly (as much as possible) the same manner. The physical arrangement and alignment of the pieces in 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 collapsed or fallen down state) until 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 hot as quickly as possible during the warm up period, thereby maximizing the amount of heat (BTU's) stored in the stove. For this stove, the thermal storage was monitored using the TOD (#4) surface temperature (s) and the peak value (s) obtained were 1108 °F 1003



Front View



Top View

The arrows indicate the direction of the air flow through the rick. Note: The top and bottom layers may be offset

The primary air was adjusted to the run setting of Wide Open 8.4 lbs above the upper charcoal bed weight.

Unit: Kuma V3
Run #: EPA 1
Date: 7/13/10
Technician: AJM JRP BDG
Page 3 of 5
WST5-Form2, Rev 12/09

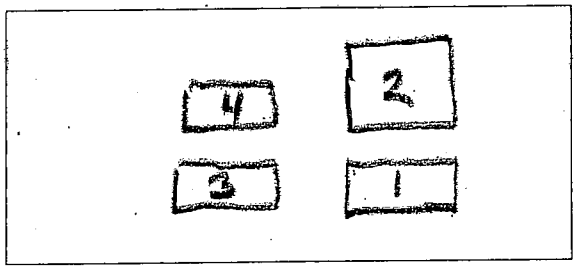
Woodstove Operating Data
Woodstove Data Sheet #9A-3

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 as soon as fuel load ignited.

Total Elapsed Time: 111
Photo Taken @: 1:140

Test Fuel Charge Loading Information:

Test Fuel Charge and Loading Sequence Diagram



END of Stove View
4 X 4's: R
2 X 4's: 1, 3, 4
Loading Sequence: 1, 2, 3, 4
Driest Pcs in Load 1, 3

Loaded the test fuel charge on an essentially level, Medium to Small sized, Average to Cool coal bed (in appearance, color and temperature) for a High burn rate.

(1) Ignition: NO:25 (2) Ignition 1:11 (3) Closed door @ 1:11. (4) Photo @ 1:40.

1:40 Flames Full Width of pcs 2 & 4 and the right ½ of the front of 1 and 2.

5:00 Fan On

Unit: Kuma V.3
Run: EPA 1
Date: 7/13/10
Technician: ATM

Fuel Moisture
Woodstove Test Data Sheet # 10

WST1-Form7-Rev 1/10

Room Temperature: 64.5 °F Correction Factor: +0.45

Note: Record readings to the nearest 0.1% moisture

Uncor Values are corrected for temperature: Yes ____ No ✓

Time Test Fuel Moisture Readings Taken at: 0945

Moisture Meter: Delmhorst Model: J-2000 SN: 34284

Calibration Checks: 12.0 12.0 MCS-1: 12.8 12.8 23.7 23.8

Scale Check
0.000 lb = 0.000
1 kg = 2.204 lb
5 kg = 11.026 lb

PC #	Dimen	Use	Top	Bottom	Side	+ Temp Correction	Piece Avg Corrected	
1	3 pcs.	K	8.7	8.6	8.0	+0.45	8.950 ✓	
2								
3	2X4 - 8'	P	20.9	18.7	21.6	+0.45	20.850 ✓	
4	↓	↓	22.3	22.5	22.2	↓	22.783 ✓	
5			19.2	22	21.5		21.350 ✓	
6	↓	↓	20.1	18.9	19.5	↓	19.950 ✓	
7							84.933 ✓	
8								
9								
10								
11	2X4 - 13.875"	T	22.6	21.9	21.4	+0.45	22.417 ✓	1.852
12	↓		20.9	19.7	19.1	↓	20.350 ✓	1.608
13	↓		20.2	22.2	22.8		22.183 ✓	1.432
14								
15	4X4 - 13.875"	T	19	18.7	18.8	↓	19.2833 ✓	3.452
16							84.233 ✓	
17								
18	5X1.5X.75 (SPACERS)	T	19.0	18.8	20.1	+0.45	19.750 ✓	1.478
19							OUT SPACERS	
20								

	Kindling	Pretest Fuel	Test Load
% Moisture – Dry Basis:	8.950 % ✓	21.23325 % ✓	21.05825 % ✓
% Moisture – Wet Basis:	8.215 % ✓	17.5144 % ✓	17.395 %

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

Acceptable Ranges: 16-20% wet; 19-25% dry

Key For Use: K= Kindling P= Pretest Fuel T= Test fuel

1 - 10.668 lbs
2 - 7.928 lbs
3 - 9.278 lbs
4 - 9.822 lbs

4X4 3.656

Unit: Kuma V.3
Run#: EPA 1
Date: 7/12/10
Technician: ATM

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): 3.82 cm

Width (W): 8.665 cm

Length (L): 8.955 cm
8.970 cm
8.945 cm
8.960 cm

Length $\bar{X}$ = 8.9575 cm

Volume: 296.496 cm^3 (D X W X L)

MOISTURE: Room Temperature: 65.6 °F Correction Factor: +0.44

Uncorrected Meter Readings Corrected for temperature: Yes ___ No ✓

NOTE: Record moisture meter readings to the nearest 0.5%

	Uncor	Cor
Top:	—	15.1 %
Bottom:	—	14.9 %
Side:	—	13.9 %
$\bar{X}$:		14.633 % + .44

Avg % Moisture (Dry) 15.073 %

Aug % Moisture (Wet) 13.099 %

Scale: Leveled In ✓ Out ___

Zeroed: In ✓ Out ___

Wet Weight: 157.2 g Dry Weight: 139.4 g

% Moisture Dried Basis: 11.323 %
[1 - (Dry Wt ÷ Wet Wt)] X 100

	Date	Time	Temp
Into Dryer	7/16/10	2022	182 °F
Out of Dryer	7/29/10	1123	202 °F

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

Density = 139.4 g (dry wt) ÷ 296.496 cm^3 (volume) = 0.4702 g/cm^3

Pellet Fuel Moisture Content Determination

Tare Beaker Wt. ___ g

Wet Wt: ___ g (Gross Wet Wt.) - ___ g (Tare Beaker Wt.) = ___ g (Net Wet Wt.)

Dry Wt: ___ g (Gross Dry Wt.) - ___ g (Tare Beaker Wt.) = ___ g (Net Dry Wt.)

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

reburn Start Wt. 8.4 Lbs. Up 552.8 lbs.
est Start Wt Range 544.4 – 544.0 lbs.
aro. Pressure 28.315 "Hg

Pre Burn Data
Record Sheet #13

Unit: Kuma V.3 Date: 7/13/10
Run: EPA 1 Technician(s): ATM JZP PDG
Page: 1 of 1 WST2-Form 16, Rev 12/ 09

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 Catalytic	11 Room Temp	Static		Comments
1148	552.8	0.0	341	657	644	602	664	433	794	1405	71	-.057		Primary Air Set At Wide Open
53	551.6	1.2	680	846	626	557	643	421	876	1488	71	-.080		Secondary Air Set At fixed
58	550.3	1.3	640	971	608	522	622	411	967	1550	71	-.084		Fan: On high ✓
1203	548.9	1.4	650	1040	603	497	619	393	1054	1610	72	-.085		Tunnel on at: 26 min.
08	547.7	1.2	640	1077	611	490	628	385	1097	1676	72	-.084		Buckets Iced ✓
13	546.5	1.2	602	1097	623	499	642	384	1158	1705	73	-.081		Analyzers Spanned ✓
18	545.6	.9	598	1087	653	524	669	388	1267	1672	73	-.081		Pumps Turned on at:
23	545.0	.6	562	1056	669	562	684	393	1213	1498	74	-.076		673.4/ΔT 0 ΔΔT
28	544.8	.2	491	926	685	593	696	400	1192	1360	73	-.090		654.6 - 18.8
33	544.6	.2	469	859	689	602	698	405	1173	1240	73	-.069		650.6 - 4.0
38	544.4	.2	446	781	689	598	692	417	1139	1165	73	-.065		635.4 - 15.2
43	544.3	.1	436	745	685	588	684	426	1125	1142	73	-.064		Tunnel ΔP 625.6 - 9.8
													X	Probe In Tunnel
1248	544.2	.1	424	716	681	576	676	435	1061	1124	73	-.063		616.8 - 8.8

Myren Cr ting Inc Data Sheet P1 of 2 Unit Kuma V.3 Date 7 / 13 / 10 Run EPA 1

Test End 544.2 ΔT 28.32 Barometric Pressure 28.32 ug Gas Flows @ 1.5" Technician(s) ATM JRP PDG CSO

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	Stack Temp #3	Stack Static Press
0	1248	544.0	9.8	0	.327	8.13		12.59	.036	.36	22.6	Bal		FAN OFF	424	-.063
05	53	553.0	8.8	1.0	.388	9.63		10.69	.115	1.15	8.4	O/B		FAN ON	533	-.071
10	58	551.8	7.6	1.2	.608	16.29		3.54	.216	2.15	7.6				586	-.080
15	1303	550.5	6.3	1.3	.659	16.31		3.72	.174	1.74	9.4				596	-.080
20	08	549.5	5.3	1.0	.659	16.31		4.09	.100	1.00	16.3	Bal	L→ML		597	-.080
25	13	548.6	4.4	.9	.641	15.87		4.72	.061	.61	26.0		"		583	-.079
30	18	547.7	3.5	.9	.642	15.89		4.44	.114	1.14	13.9		"		577	-.079
35	23	547.1	2.9	.6	.539	13.36		7.50	.009	.09	148.4		clear	ends FWD DIV	536	-.076
40	28	546.7	2.5	.4	.450	11.16		9.71	.005	.05	223.2				509	-.073
45	33	546.3	2.1	.4	.405	10.05		10.81	.007	.07	143.6				477	-.070
50	38	546.0	1.8	.3	.463	11.48		9.35	.014	.14	82.0				462	-.069
55	43	545.8	1.6	.2	.348	8.65		12.18	.014	.14	61.8				447	-.067
Total															6327	-.837

M5G-2

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 #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	YM 5G2 Hot Box #17	Imp #18
0	1248	716	681	576	676	435	1061	1124	73	112	240	35	62	54	213	34
05	53	735	664	543	655	499	921	1154	73	127	211	36	67	36	222	34
10	58	897	654	492	640	467	966	1416	73	130	222	36	75	36	209	35
15	1303	967	657	475	636	448	1026	1557	74	132	236	36	75	36	219	35
20	08	991	662	474	638	437	1061	1607	74	132	237	37	75	36	248	36
25	13	1018	677	480	648	429	1109	1646	74	131	230	37	75	36	242	36
30	18	1022	688	488	656	424	1139	1645	74	130	218	37	74	36	214	36
35	23	982	703	497	666	423	1140	1541	74	126	206	37	73	36	220	36
40	28	916	712	499	672	422	1158	1421	75	122	194	37	72	36	229	36
45	33	849	716	500	673	422	1141	1392	74	118	196	37	71	36	223	36
50	38	804	711	505	671	421	1095	1337	74	116	206	38	71	36	222	36
55	43	764	700	519	664	418	1081	1356	73	114	211	38	70	36	228	36
Total		10661	8225	6048	7895	5245	12898	17196	885							

Myren C ulting Inc Data Sheet P2 of 2 Unit Kuma V.3 Date 7 / 13 / 10 Run EPA 1

Test End Wt. 616.8 ΔT 28.32 Barometric Pressure 28.32 "hg Gas Flows @ 1.5" Technician(s) ATM JRP PAE CSO

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	1348	545.5	1.3	.3	.333	8.28		12.55	.014	.14	59.1					440	-.066
65	53	545.3	1.1	.2	.320	7.96		12.86	.017	.17	46.8					430	-.065
70	58	545.1	.9	.2	.307	7.64		13.15	.022	.22	34.7					425	-.064
75	1403	545.0	.8	.1	.249	6.21		14.13	.053	.53	11.7					395	-.060
80	08	544.9	.7	.1	.218	5.44		15.10	.071	.71	7.7	4X4 End Blocking				381	-.059
85	13	544.8	.6	.1	.223	5.56		14.97	.074	.74	7.6					368	-.058
90	18	544.7	.5	.1	.222	5.54		14.98	.077	.77	7.2	Avg ÷23				364	-.056
95	23	544.6	.4	.1	.206	5.15		15.37	.077	.77	6.7					352	-.055
100	28	544.4	.2	.2	.215	5.37		15.14	.079	.79	6.8					349	-.054
105	33	544.3	.1	.1	.196	4.90		15.63	.074	.74	6.6					342	-.054
110	38	544.2	0	.1	.194	4.85		15.67	.076	.76	6.4					338	-.053
115																(4184)	(.644)
Tot													Grand Total			(10511)	(-1.481)
													M56-2 Avg			(457)	(.064)

Time E/T min	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	~~Tube 1~~ Hot Box #17	~~Tube 2~~ Impinger #18	Tube 3 #19	H_2O II box #20
60	1348	745	693	525	659	415	1063	1322	74	113	216	37	70	36	238	36		
65	53	717	680	536	649	412	1050	1260	73	111	220	37	70	36	241	36		
70	58	702	673	539	642	409	1053	1222	74	111	221	37	70	36	233	36		
75	1403	653	658	539	633	409	1001	1038	73	108	218	37	69	36	224	36		
80	08	623	645	531	624	407	955	979	74	106	215	37	69	36	224	36		
85	13	585	625	515	607	403	936	954	73	104	217	37	69	36	230	36		
90	18	573	616	511	598	400	924	943	74	104	222	37	69	36	230	36		
95	23	546	598	503	581	396	896	910	73	103	222	37	69	36	227	36		
100	28	534	587	501	571	393	886	925	73	102	219	37	69	36	222	36	ΔT	
105	33	520	573	504	560	389	858	891	73	101	217	37	69	36	223	36	Start	616.8
110	38	508	562	505	549	385	840	888	73	101	217	37	69	36	225	36	Stop	501.8
115		(6706)	(8110)	(5709)	(6673)	(4418)	(10462)	(11332)	(807)								ΔΔT	-115.0
Tot		(17367)	(15135)	(11757)	(14516)	(9963)	(23369)	(28528)	(1692)									
Avg ÷23		(755)	(658)	(511)	(633)	(433)	(1016)	(1240)	(74)									

Pre and Post Test Zero/Span Check
Woodstove Data Sheet # 15-1

Site: Myren Consulting, Colville, WA Date: 7/13/10 Analyte: CO_2

Source: Kuma V.3 Run #: FPA 1

Zero Cyl #: AA-9167 Conc. 00.0 % CO_2 Cyl Press: 2040 psi

Certified By: Oxarc Date: 5/11/09

Span Cyl #: SX-45410 Conc. 12.6 % CO_2 Cyl Press: 1600 psi

Certified By: Matheson Tri Gas Date: 4/12/10

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 Values= 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: 1206 Temp: 68 °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	.0665	+0.06655	+0.27
Span	50.0	.500	12.5	50.5	.504	12.4926	-0.1074	-0.85

Comments:

Post Run Audit: By: A.T.Myren Time: 1527 Temp: 70 °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	.0665	+0.06655	+0.27
Span	50.0	.500	12.5	50.5	.505	12.5172	-0.0827	-0.66

Comments:

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

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

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

Pre and Post Test Zero/Span Check
Woodstove Data Sheet # 15-3

Site: Myren Consulting, Colville, WA Date: 4/13/10 Analyte: CO

Source: Kuma U,3 Run #: 1

Zero Cyl #: AA-9167 Conc. 00.0 % CO Cyl Press: 2040 psi

Certified By: Oxarc Date: 5/11/09

Span Cyl #: SY-45410 Conc. 2.55 % CO Cyl Press: 1600 psi

Certified By: Matheson TRI GAS Date: 4/12/10

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

Range: 0 - 10.0% CO (0 – 5.0% CO) Analyzer Output: 0 – 1.0 v.

Flow: 1.5 SCFH Measured By: Rotameter: X Flowmeter: _____

EPA Span Values= 5.0% CO

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

Pre Run Audit: By: A.T. Myren Time: 1206 Temp: 68 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	0,00	,000	.00716	+0.00716	+0.14
Span	2,55	,255	2,55	2,55	,254	2.4906	-0.05942	-2.33

Comments:

Post Run Audit: By: A.T. Myren Time: 1522 Temp: 70 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	0.00	.000	.00716	+0.00716	+0.14
Span	2,55	,255	2,55	2.53	.252	24710	-0.07897	-3,10

Comments:

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

Zero % Difference(Δ%) = (Act % (ppm) – Exp % (ppm)) / Full Scale Value X 100

Span % Difference (Δ%)= (Act % (ppm) – Exp % (ppm)) / Exp % (ppm) X 100

Unit: Kuma V13
Run: EPA
Date: 7/ 110
Technicians: AM JRP PDG
WST6-Form3, Rev 12/09

Quality Checks
Woodstove Data Sheet #16

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

Thermocouple Check (at ambient): T/C # 1: — °F; T/C#2: 64.8 °F
T/C # 3: 63.9 °F; T/C # 4: 65.5 °F; T/C #5: 65.6 °F;
T/C # 6: 65.0 °F; T/C # 7: 65.6 °F; T/C # 8: 59.1 °F;
T/C # 9: 66.3 °F; T/C # 10: 66.2 °F; T/C # 11: 58.1 °F;
T/C # 12: 65.1 °F; T/C # 13: 65.9 °F; T/C # 14: 63.1 °F;
T/C # 15: 55.8 °F; T/C # 16: 69.3 °F; T/C # 17: 53.4 °F;
T/C # 18: 62.2 °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	Adj	Post Test Check	%Difference
(0°F): −0.5 °F	to: — °F	Zero (0°F): 1.1 °F	+0.24
Span	Adj	Span	
(2000°F): 1999.1 °F	to: — °F	(2000°F): 1999.9 °F	+0.004

(Allowable % Difference = 1.5%. Use Formulas on Woodstove Data Sheet #15 to calculate % Difference, % Difference calculated in degrees absolute.)

Thermocouple Readout Pretest Linearity Check

0°F = 0.9 °F; 200°F = 202.1 °F; 400°F = 399.4 °F
600°F = 601.5 °F; 800°F = 801.5 °F; 1000°F = 1000.6 °F
1200°F = 1198.2 °F; 1400°F = 1399.1 °F; 1600°F = 1599.4 °F
1800°F = 1799.4 °F; 2000°F = 1999.2 °F

Combustion Gas (CO_2, O_2, CO) Train Leak Check: Pre OK √ PDG Post OK √ PDG
Draft (Static) Guage Zero Check: Pre OK √ JRP Post OK √ JRP
Scale Check Pre (Wt. #'s): 547.9 − 542.9 = 5 Lbs / 5 Lbs = OK JRP
Post (Wt. #'s): 549.1 − 544.1 = 5.0 lbs / 5.0 lbs = OK AM

Stack Cleaned Prior to the Run: Yes ✓ No _____
Tunnel Cleaned Prior to the Run: Yes ✓ No _____

EPA 5 .10 FCT

DILUTION TUNNEL CALCULATIONS

MYREN CONSULTING CERTIFICATION TEST DATA

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

File Name:	EPA 5
Manufacturer:	KUMA
Model Number:	V.3
Lab Name:	MYREN
Test Date:	7\20\10
Run Number:	EPA 5
Meter Box Y Factor:	1.0159
Barometric pressure (in):	28.305
Gas meter temp (ave):	**92**
delta H(avg):	**0.900**
Gas meter initial reading:	980.8020
Gas meter final reading:	1083.4520
Front catch (acetone) mg:	4.19
first filter catch (mg):	23.2
second filter catch (mg):	-0.7
Tunnel Flow (Qsd) (dscfm)	**147.420**
Emission Rate(g/hr):	**2.498**
Emission Rate(M5H) :	**3.891**
Avg. of Delta P Sq. Roots:	**0.2077**
Vs (Avg.)(ft/min):	**878.615**
Tunnel Avg. Temperature (F):	**100.762**
Test time(min):	195
Fuel Load(lb. wet):	9.822
Wood moisture(%wet):	16.949
Burn rate(dry kg/hr):	**1.138**
Sample Volume (dscf)	**94.498**
Avg. Tunnel Static (-inch H2O):	**0.1687**
Room Blank Catch (mg/dscf):	0
Emission Factor (g/kg):	**2.1943**
Pitot Correction Factor:	0.97421
front filter number	52
back filter number	51
Beaker Number:	39
PRELIMINARY RESULTS	
FINAL RESULTS:	AUDITED

DATA SUMMARY

MODEL:	V.3
RUN:	EPA 5
DATE:	7\20\10
DBR:	1.138
EMISSION RATE (g/hr)(M5H)	3.8914
EMISSION FACTOR (g/kg):	2.1943
AVG. % PROPORTIONALITY :	99.650

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	0.042	97	980.8020	73	0.900	864.05			0.170	0.2049	
10	0.044	107	986.0240	76	0.900	892.29	104.9	4.953	0.174	0.2098	
20	0.043	105	991.2110	80	0.900	880.53	103.6	4.884	0.171	0.2074	
30	0.044	106	996.4200	85	0.900	891.50	101.1	4.859	0.170	0.2098	
40	0.043	107	1001.6280	87	0.900	882.09	101.6	4.841	0.170	0.2074	
50	0.044	105	1006.8680	90	0.900	890.71	99.8	4.844	0.170	0.2098	
60	0.043	102	1012.1280	91	0.900	878.20	100.7	4.854	0.174	0.2074	
70	0.043	101	1017.4030	93	0.900	877.41	100.1	4.850	0.171	0.2074	
80	0.043	99	1022.7020	94	0.900	875.85	100.0	4.863	0.172	0.2074	
90	0.045	99	1027.9710	95	0.900	895.98	96.9	4.827	0.171	0.2121	
100	0.045	98	1033.2530	96	0.900	895.18	96.7	4.830	0.171	0.2121	
110	0.044	97	1038.5300	97	0.900	884.38	97.3	4.817	0.169	0.2098	
120	0.043	97	1043.8260	97	0.900	874.27	98.7	4.834	0.167	0.2074	
130	0.044	96	1049.0110	98	0.900	883.59	95.1	4.724	0.167	0.2098	
140	0.044	98	1054.3900	98	0.900	885.17	98.9	4.901	0.164	0.2098	
150	0.043	99	1059.6780	98	0.900	875.84	98.4	4.818	0.163	0.2074	
160	0.042	100	1064.9670	98	0.900	866.37	99.7	4.819	0.166	0.2049	
170	0.042	100	1070.2470	98	0.900	866.37	99.5	4.811	0.165	0.2049	
180	0.041	101	1075.5370	98	0.900	856.76	101.0	4.820	0.167	0.2025	
190	0.042	101	1080.8120	98	0.900	867.14	99.5	4.806	0.165	0.2049	
195	0.042	101	1083.4520	98	0.900	867.14	99.6	2.405	0.165	0.2049	
210			0.0000			0.00	0.0	0.000		0.0000	
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	

MYREN CONSULTING, INC.
6 Inch Dilution Tunnel Traverse Data

Unit: kuma V.3
Run #: 7 / 20 / 10
Date: EPA 5
Technicians: AJM JRP

Rev 2/22/09

Point	Location	Δp	$\sqrt{\Delta p_{trav}}$	$\sqrt{\Delta p_{cent}}$	#/2 T_{trav}	#/2 T_{cent}	Pg
W-1	0.5"	.038	.1949		99		
2	1.5	.044	.2098		99		
Center	Center	.043		.2074		99	-.170
3	4.5	.041	.2025		99		
4	5.5	.039	.1975		99		
S-1	0.5	.038	.1949		99		
2	1.5	.041	.2025		98		
Center	Center	.042		.2049		99	-.169
3	4.5	.043	.2074		99		
4	5.5	.039	.1975		99		
	Totals		1.6070	.4123	979 1	198	-.339
	Average		.2009	.20615	98.875	99	-.1695
	°R = (°F + 460)				558.9	559	

BP: 28.34 in. Hg Ps = BP+(Pg/13.6) = 28.34 + (-.1695/13.6) = 28.328 in. Hg

LEAK CHECKS:
Pre Test: Pg Leg: OK ORP Velocity Head Leg: OK ORP
Post Test: Pg Leg: Ok AMM Velocity Head Leg: Ok AMM

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

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

UNIT: Kuma V.3 DATE: 7/20/10 RUN #: EPA 5 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) (.2009 $\bar{X}$ $\sqrt{\Delta P}$ "H_2O) $\sqrt{\frac{558.9 \text{ Ts °A}}{(28.328 \text{ Ps "Hg})(28.56 \text{ lb./ lb. mole})}}$ = 14.13222 fps

{2} {2} {0} {2} {2} {2}

(9A) Vs = (14.13222 fps) (60) = 847.933 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) (.2062 $\bar{X}$ $\sqrt{\Delta P}$ "H_2O) $\sqrt{\frac{559 \text{ Ts °A}}{(28.328 \text{ Ps "Hg})(28.56 \text{ lb./ lb. mole})}}$ = 14.50635 fps

{2} {2} {0} {2} {2} {2}

(9A) Vs = (14.50635 fps) (60) = 870.381 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 = 14.13222 ÷ 14.50635 = 0.97421

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) (14.13222 fps) (.1963 ft^2) [(528 °A) (28.328 Ps "Hg) / (558.9 T_s °A) (29.92" Hg) =

{2} {3} {2} {0}

8,575.484 dscfhr (or dscfh)

{1}

(10A) 8,575.484 dscfhr ÷ 60 = 142.925 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.

M5G-1

Unit: Kuma V.2
Run: EPA 5
Date: 7/20/10
Page 1 of 2 Rev 5/10

Method 5G Particulate Sampling Data

Meter Box 45G-P Meter Y 1.0159 Filter #'s: (F) 52 (R) 51

.6315/.6315 Filter/O-Ring ID #: —

Pre Test Leak Check: .000 CFM@ −15.6 in Hg Filter Size: 110 mm

.6095/.610 Probe ID #: —

Post Test Leak Check: .0005 CFM@ −15.2 in Hg Probe Length 21.5 in

Time		Meter Reading (m³)(ft³)	Pitot		Tunnel Temp (°F)	Meter Temp (°F)	Gas Meter Δh	Vac (in Hg)
Clock	Elapsed		ΔP	Pg				
1235	00	980.802	.042	-.170	97	73	0.90	0
45	10	986.024	.044	-.174	107	76	.90	0
55	20	991.211	.043	-.171	105	80	.90	0
1305	30	996.420	.044	-.170	106	85	.90	0
15	40	1001.628	.043	-.170	107	87	.90	0
25	50	1006.868	.044	-.170	105	90	.90	0
35	60	1012.128	.043	-.174	102	91	.90	0
45	70	1017.403	.043	-.171	101	93	.90	0
55	80	1022.702	.043	-.172	99	94	.90	0
1405	90	1027.971	.045	-.171	99	95	.90	0
15	100	1033.253	.045	-.171	98	96	.90	0
25	110	1038.530	.044	-.169	97	97	.90	0
35	120	1043.826	.043	-.167	97	97	.90	0
45	130	1049.011	.044	-.167	96	98	.90	0
55	140	1054.390	.044	-.164	98	98	.90	0
1505	150	1059.678	.043	-.163	99	98	.90	0
15	160	1064.967	.042	-.166	100	98	.90	0
25	170	1070.247	.042	-.165	100	96	.90	0
35	180	1075.537	.041	-.167	101	96	.90	0
45	190	1080.812	.042	-.165	101	96	.90	0

BP

00	28.33		
60	28.32		
120	28.30		
180	28.29		
195	28.285	Avg. =	28.305

Pre Test Filter Check Weighing
F .6448
R .6419

End of Test Weight .6913
F .6687 R
.6689 .6416
.6449 .6421
.0240 −.0005
238 −.0006

M5G-1

Unit: Kuma V.3
Run: EPA 5
Date: 7/20/10
Page 2 of 2 Rev 5/10

Method 5G Particulate Sampling Data

Meter Box 457-P Meter Y 1.0159 Filter #'s: (F) 52 (R) 51

1.6315 / 1.6315 Filter/O-Ring ID #: —

Pre Test Leak Check: 0.000 CFM@ -15.6 in Hg Filter Size: 110 mm

.6095 / .610 Probe ID #: —

Post Test Leak Check: .0005 CFM@ -15.2 in Hg Probe Length 21.5 in

Time		Meter Reading (m^3)(ft^3)	Pitot		Tunnel Temp (°F)	Meter Temp (°F)	Gas Meter Δh	Vac (in Hg)
Clock	Elapsed		ΔP	Pg				
1550	19~~00~~	1083.452	.042	-1.65	101	98	.90	0
	10							
	20							
	30							
	40							
	50							
	60							
	70							
	80							
	90							
	00							
	10							
	20							
	30							
	40							
	50							
	60							
	70							
	80							
	90							

BP

00	28.33		
60	28.32		
120	28.30		
180	28.29		
195	29.265	Avg. =	28.305

Pre Test Filter Check Weighing
F .6448
R .6419

End of Test Weight

F	R
.6689	.6416
.6449	.6421
.0240	-.0005

SCALE 2

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

Into Dessicator: Date 11/20/09 Time 0957 By PDG Front Half ✓ Back Half ✓

Manufacturer: PALL P/N 60115 Size: 110mm Lot.No.: T72680 Grade: A/E GLASS

Filter #	First Wt	2010 Date	Time	By	Second Wt	2010 Date	Time	By	Third Wt	Date	Time	By
051	.6423	7/14	1714	PDG	.6421	7/15	1453	JRP				
052	.6449		1715	PDG	.6449		1452	JRP				
053	.6393		1716	PDG	.6395		1451	JRP				
054	.6436		1717	PDG	.6436		1450	JRP				
055	.6416		1718	PDG	.6414		1449	JRP				
056	.6462		1719	PDG	.6460		1448	JRP				
057	.6438		1719	PDG	.6437		1447	JRP				
058	.6444		1720	PDG	.6444		1446	JRP				
059	.6443		1721	PDG	.6443		1445	JRP				
060	.6451		1722	PDG	.6452		1444	JRP				
061	.6405		1722	PDG	.6404		1443	JRP				
062	.6417		1723	PDG	.6416		1442	JRP				
063	.6413		1724	PDG	.6412		1441	JRP				
064	.6425		1725	PDG	.6423		1440	JRP				
065	.6430		1726	PDG	.6429		1439	JRP				
066	.6426		1727	PDG	.6424		1438	JRP				
067	.6462		1727	PDG	.6459		1437	JRP				
068	.6430		1728	PDG	.6427		1436	JRP				
069	.6386		1728	PDG	.6383		1435	JRP				
070	.6400		1729	PDG	.6396		1434	JRP				
071	.6401		1730	PDG	.6398		1433	JRP				
072	.6427		1731	PDG	.6423		1432	JRP				
073	.6421		1732	PDG	.6418		1431	JRP				
074	.6440		1733	PDG	.6440		1430	JRP				
075	.6420	↓	1733	PDG	.6419	↓	1429	JRP				

Checked by A.T. Myren Date: 7/15/10 Time 1351

QA REWEIGH

Filter #	WT	Date	Time	By
50	.6447	7/16	1825	JRP
56	.6461	7/16	1826	JRP
64	.6425	7/16	1827	JRP

Post

7/14	7/15	7/16
0.0000	0.0000	0.0000
100.0000	99.9994	99.9993

BALANCE ROOM ENVIRONMENTAL CONDITIONS

WB	DB	%RH	2010 Date	Time	By
42	75	46	7/14	1640	PDG
60	73	46	7/15	1128	ATM
61	75	44	7/16	1810	ATM

Woodstove Data Sheet #4-2: Initial Beaker Weights (Tare Weights)

Into Dessicator: Date 7/12/10 **Time** 1313 **By** JRP

Balance Used: Sartorius 2 **Model:** ~~CP224S~~ CPA 225 **SN:** ~~17050374~~

	Beaker #	First Wt	2010 Date	Time	By	Second Wt	2010 Date	Time	By	Third Wt	Date	Time	By
*	20	73.3182	7/14	1643	PDH	73.3193	7/15	1419	JRP	73.3188	7/16	1824	
*	21	71.0024		1644	PDH	71.0026	7/15	1417	JRP	71.0025	7/16	1822	
	28	70.5972		1646	PDH	70.5977	7/15	1415	JRP				
	32	53.6005		1647	PDH	53.6006	7/15	1414	JRP	53.6007	7/20	2221	
	34	53.2616		1648	PDH	53.2620	7/15	1412	JRP				
	35	53.2815		1649	PDH	53.2818	7/15	1210	ATM	53.2818	7/20	2218	
	38	53.2525		1650	PDH	53.2530	7/15	1209	ATM	53.2534	7/20	2220	
	39	53.1509		1651	PDH	53.1510	7/15	1206	ATM				RON
(#)	42	53.8698		1652	PDH	53.8688	7/15	1147	ATM	53.8704	7/16	1820	
+	25	72.6522	7/20	2233		72.6522	7/27	2240	ATM				
	Into Dessicator		7/16/10	@		1750	(ATM)						
	41	53.8386	7/17	1843	ATM	53.8376	7/18	2045					
	43	53.2328	7/17	1850	ATM	53.2328	7/188	2058					
+	29	71.5188	7/20	2223		71.5186	7/27	2246	ATM				
→	42	53.8705	7/17	1834	ATM	53.8686	7/27	2248	ATM				
	21	71.0025	7/17	1837	ATM								
+	22	71.8334	7/20	2222		71.8330	7/27	2249	ATM				
	Into Dessicator		7/17/10	@		1922	ATM						
	31												
	36	70.7854	7/20	2211		70.7854	7/27	2237	ATM				
+	40	53.4631	7/20	2217		53.4633	7/27	2236	ATM				
+	24	73.2183	7/20	2213		73.2181	7/27	2234	ATM				

Checked by _____ **Date:** _____ **Time:** _____

QA Reweigh

Beaker #	WT	Date	Time	By
28	70.5988	7/16	1824	

Balance Room Environmental Conditions

WB	DB	%RH	Date 2010	Time	By
62	75	46	7/14	1640	DH
60	73	46	7/15	1128	ATM
61	75	44	7/16	1810	ATM
60	73	46	7/17	1800	ATM
61	74	47	7/18	2015	ATM

Post Weighing	Date	1st	2nd	3rd	4th	5th
Scale Check	0.0000g	0.0000	0.0000	0.0000	0.0000	0.0000
	100.0000g	99.9994	99.9994	99.9994	99.9995	9.9995

Given 0.0000

62 7045 7/20 2211 ATM

Woodstove Data Sheet #4-2: Initial Beaker Weights (Tare Weights)

Scale 2

Into Dessicator: Date 4 May 10 Time 0940 By ATM

Balance Used: Sartorius Model: CP224S SN: [redacted]

Beaker #	First Wt	Date	Time	By	Second Wt	30D Date	Time	By	Third Wt	Date	Time	By
20	3171	5/5	1453	ATM	73.3176	5/7	1641					
8	71 .0018		1504	ATM	71.0022	5/7	1704		71.0018	5/8/10	1245	ATM
22	71 .8331		1503	ATM	71.8344	5/7	1705		71.8337	5/8/10	1246	ATM
23	70. 7386		1455	ATM	70.7392	5/7	1708		70.7385	5/8/10	1227	ATM
24	73. 2178		1456	ATM	73.2187	5/7	1700		73.2187	5/8/10	1229	ATM
25	72. 6511		1459	ATM	72.6516	5/7	1650		72.6511	5/11/10	1447	ATM
26	71. 7872		1507	ATM	71.7879	5/7	1647		71.7875	5/11/10	1438	ATM
27	72 .3304		1508	ATM	72.3311	5/7	1657		72.3305	5/10/10	1243	ATM
29	71 .5185		1510	ATM	71.5198	5/7	1656		71.5193	5/11/10	1543	ATM
30	70 .7855		1511	ATM	70.7856	5/7	1658		70.7855	5/11/10	1641	ATM
32	53. 5986		1506	ATM	53.5999	5/7	1702		53.5996	5/8/10	1235	ATM
33	53 .1475		1505	ATM	53.1488	5/7	1701		53.1484	5/11/10	1437	ATM
36	53 .5736		1501	ATM	53.5747	5/7	1707		53.5742	5/8/10	1238	ATM
38	53 .2513		1500	ATM	53.2523	5/7	1703		53.2520	5/10/10	1239	ATM
40	53. 4617		1457	ATM	53.4625	5/7	1706		53.4624	5/8/10	1236	ATM
41	52. 8355		1458	ATM	52.8364	5/7	1707		52.8368	5/8/10	1229	ATM
43	53 .2319	↓	1440	ATM	53.2333	5/7	1640					
31	69.6666	5/7/10	1655		69.6666	5/11	1445	ATM				
37	53.7263	5/7/10	1646		53.7259	5/11	1440	ATM				
(cont.)												
22	71.8338	5/11/10	1623									
27	72.3287	5/11/10	1622		72.3305	5/11/10	1500	ATM	72.3304	6/2/10	1620	

Blank

Checked by ATM **Date:** 6/2/10 **Time:** 1610

QA Reweigh

Beaker #	WT	Date	Time	By
22	71.8339	6/2/10	1617	ATM
32	53.5997	6/2/10	1619	
21	71.1003	6/2/10	1620	

Balance Room Environmental Conditions

WB (F)	DB (F)	%RH	Date 5/5	Time 1126	By ATM
59	73	42	5/7/10	1600	ATM
59	71	48	5/8/10	1140	ATM
55	68	42	5/11/10	1349	ATM
60	73	46	5/12/10	1314	ATM
61	75	46	6/2/10	1602	ATM

Post Weighing	Date	1st	2nd	3rd	4th	5th	6th
	0.0000g	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Scale Check	100.0000g	99.9996	99.9995	99.9995	99.9995	99.9995	99.9995

MSG-1 Unit Kuma V.3

Woodstove Data Sheet #4-3: Constant Final Weights

Run # EPA 5

Date: 7/20/10

55 M1

WST5-Form 9, Pg 1, Rev 5/10

Final Beaker Weights

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
39	53.1509	7/21	1828	ATM	53.1559	7/22	1644	ATM	53.1563	7/26	2159	[illegible]	53.1550	7/27	2251	ATM
					53.1552	7/28	1426	[illegible]	53.1553	7/29	1351	ATM				

Final Filter Weights

	Filter #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
F	52	.6689	7/20	2110	ATM	.6687	7/21	1733	ATM	.6685	7/22	1640	ATM	(.6681)	7/26	2157	[illegible]
R	51	.6416	7/20	2110	ATM	.6415	7/21	1729	ATM	.6414	7/22	1643	ATM				

QA Reweigh: Final Weight

Date	Beaker #	Final Wt	By

Date	Filter #	Final Wt	By

Scale Room Environmental Conditions

Weighing Session	2010 Date	Time	By	WB	DB	%RH
1	7/21	1715	ATM	63	77	45
2	7/22	1617	ATM	61	74	46
3	7/26	2141	ATM	62	76	45
4	7/27	2206	ATM	63	76	49
5	7/28	1340	ATM	64	77	49
6	7/29	1330	ATM	64	77	49

Scale Room Environmental Conditions

7					
8					
9					
10					
11					

Comments

Acetone Blank 7/13/10
BLK 20 50ml Acetone
Lot # 074092 Tare Wt. 71.5193

Kuma

Unit Kuma V.3
Run # EPA 5
Date: 7/20/10

Woodstove Data Sheet #4-3: Constant Final Weights

WST5-Form 9, Pg 1, Rev 5/10

Final Beaker Weights

Beaker #	Into Dessic	Date	Time	By	First	Date	Time	By	Second	Date	Time	By	Third	Date	Time	By
20	71.5194	7/20	1546	AM	71.5180	7/31	1111	ATM	71.5195	7/31	2028	JC	71.5194	8/1	0941	ATM

Final Filter Weights

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

QA Reweigh: Final Weight

Date	Beaker #	Final Wt	By

Date	Filter #	Final Wt	By

Scale Room Environmental Conditions

Weighing Session	Date	Time	By	WB	DB	%RH
1	7/31	1020	ATM	58	72	42
2	7/31	2005	ATM	64	77	49
3	8/1	0936	ATM	64	77	49
4						
5						
6						

Scale Room Environmental Conditions

7					
8					
9					
10					
11					

Comments

Woodstove Data Sheet 4-4 Scale QC Record Sheet

Scale 1

From: 7/20/10
Through:

Scale: Sartorius
Model: CP224S
SN: 17050374
Rev: 3/10

* 135.00000 g = 100.0000 + 20.0000 + 10.0000 + 5.0000 wts, 100g wt = 99.9991 - 90

Level	Recalibrated	130g * Weights	100g Weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	2010 Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9988	99.9989	9.9999	1.0000	0.1000	0.0199	7/20	1350	ATM	28.36	59	72	45	118
Yes	Yes	134.9988	99.9989	9.9999	0.9999	0.0999	0.0199	7/21	1715	ATM	28.22	63	77	45	117
Yes	No	134.9988	99.9989	10.0000	1.0000	0.1000	0.0199	7/22	1617	ATM	28.16	61	74	46	119
Yes	Yes	134.9989	99.9990	9.9999	1.0000	0.0999	0.0199	7/26	2141	ATM	28.15	62	76	45	120
Yes	No	134.9990	99.9991	9.9999	1.0000	0.0999	0.0199	7/27	2206	ATM	28.32	63	76	49	118
Yes	No	134.9991	99.9992	9.9999	1.0000	0.1000	0.0199	7/28	1340	ATM	28.34	64	77	49	116
Yes	No	134.9989	99.9990	9.9999	1.0001	0.1001	0.0200	7/29	1330	ATM	28.41	64	77	49	115
Yes	No	134.9990	99.9991	9.9999	1.0000	0.1000	0.0199	7/30	1639	ATM	28.25	64	77	49	116
Yes	No	134.9989	99.9989	9.9999	0.9999	0.0999	0.0199	7/31	1020	ATM	28.29	58	72	42	116
Yes	No	134.9990	99.9991	9.9999	1.0000	0.1000	0.0199	7/31	2005	ATM	28.22	64	77	49	119
Yes	Yes	134.9988	99.9989	9.9999	0.9999	0.1000	0.0199	8/1	0926	ATM	28.32	56	68	46	116
Yes	No	134.9988	99.9989	9.9999	1.0001	0.0999	0.0199	8/1	2050	ATM	28.30	61	74	47	117
Yes	Yes	134.9988	99.9989	9.9999	1.0001	0.1000	0.0199	8/2	0756	ATM	28.40	59	70	48	117
Yes	Yes	134.9988	99.9989	9.9999	1.0000	0.1001	0.0199	8/3	1600	JRP	28.34	58	70	48	116

Woodstove Data Sheet 4-4 Scale QC Record Sheet All Scales and Desiccators Individually Grounded New. Scale: Sartorius

From: 5/31/10 **Scale 1** Model: CP224S

Through: 7/19/10 SN: 17050374 Line

* 135.0000g = 100.0000 + 20.0000 + 10.0000 + 5.0000 wts. 100g wt = 99.9991-99.9990 Rev: 3/10 Volta

Level	Recali-brated	130g* Weights	100g Weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9992	99.9992	9.9999	1.0001	0.1001	0.0200	5/31/10	10:45	ATM	28.21	58	70	48	120
Yes	No	134.9992	99.9993	10.0000	1.0001	0.1001	0.0200	6/1/10	14:45	ATM	28.22	57.5	70	46	119
Yes	Yes	134.9990	99.9990	9.9999	1.0001	0.1000	0.0199	6/2/10	1602	ATM	28.09	61	75	46	118
Yes	Yes	134.9989	99.9989	9.9999	0.9999	0.1000	0.0201	6/3/10	1450	ATM	28.20	57	69	46	120
Yes	No	134.9991	99.9991	9.9999	1.0001	0.1001	0.0199	6/4/10	0950	ATM	28.09	55	68	42	120
Yes	No	134.9989	99.9990	9.9999	0.9999	0.1000	0.0199	6/7/10	1350	ATM	28.40	60	72	49	119
Yes	No	134.9989	99.9990	9.9999	1.0000	0.1000	0.0199	6/10/10	1545	ATM	28.395	58	70	48	121
Yes	No	134.9990	99.9990	9.9999	1.0000	0.1000	0.0199	6/11/10	1440	ATM	28.57	61	74	46	120
Yes	No	134.9990	99.9991	9.9999	1.0000	0.1001	0.0200	6/13/10	2035	ATM	28.33	58	71	44	120
Yes	No	134.9991	99.9990	10.0000	1.0001	0.1001	0.0199	6/15/10	1438	ATM	28.28	59	72	45	120
Yes	No	134.9990	99.9990	10.0000	0.9999	0.1000	0.0199	6/22/10	2041	ATM	28.45	58	70	48	121
Yes	No	134.9993	99.9993	10.0000	1.0000	0.1000	0.0199	6/23/10	2230	ATM	28.45	64	77	48	118
Yes	Yes	134.9989	99.9989	9.9999	0.9999	0.1000	0.0199	6/27/10	1710	ATM	28.09	60	74	43	117
Yes	Yes	134.9989	99.9989	9.9999	0.9999	0.0999	0.0199	6/29/10	1407	ATM	28.20	61	74	47	119
Yes	Yes	134.9989	99.9989	9.9999	1.0001	0.1001	0.0199	7/5/10	1705	ATM	28.38	58	70	48	118
YES	Yes	134.9988	99.9989	9.9999	0.9999	0.1000	0.0199	7/6/10	1250	JRP	28.48	57	68	50	118
Yes	Yes	134.9988	99.9989	9.9999	1.0000	0.1000	0.0199	7/6/10	1630	ATM	28.52	58	70	48	121
Yes	Yes	134.9988	99.9989	9.9999	1.0000	0.0999	0.0199	7/7/10	0645	ATM	28.52	58	70	48	120
Yes	No	134.9992	99.9992	9.9999	1.0000	0.1000	0.0199	7/8/10	1409	ATM	28.43	64	77	49	117
Yes	No	134.9991	99.9992	9.9999	1.0000	0.1000	0.0199	7/10/10	2145	ATM	28.04	61	74	46	119
Yes	No	134.9991	99.9992	9.9999	1.0000	0.1000	0.0199	7/12/10	1109	ATM	2795	60	72	48	119
Yes	Yes	134.9988	99.9989	9.9999	1.0000	0.1000	0.0199	7/13/10	1426	ATM	28.35	55	67	45	119
Yes	No	134.9988	99.9989	9.9999	1.0001	0.1001	0.0200	7/14/10	1444	ATM	28.48	58	70	48	115
Yes	No	134.9988	99.9989	9.9999	1.0000	0.1000	0.0199	7/15/10	1128	ATM	28.43	60	73	46	118
Yes	No	134.9989	99.9990	9.9999	0.9999	0.1000	0.0199	7/16/10	1810	ATM	28.28	61	75	44	116
Yes	No	134.9989	99.9990	9.9999	0.9999	0.0999	0.0199	7/17/10	1800	ATM	28.29	60	73	46	121
Yes	No	134.9991	99.9991	10.0000	1.0000	0.1000	0.0199	7/18/10	2015	ATM	28.25	61	74	47	120
Yes	No	134.9989	99.9990	9.9999	1.0000	0.1000	0.0199	7/19/10	1040	ATM	28.40	60	73	46	119

Woodstove Data Sheet 4-4 Scale QC Record Sheet
Scale 2

From: 7/27/10
Through: _____

Scale: Sartorius
Model: CPA 2245
SN: 24850860
Rev: 5/10

2010

Level	Recalibrated	135g Weights	100g Weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9996	99.9995	9.9999	1.0000	0.1000	0.0200	7/27/10	2200	ATM	28.32	63	76	49	110
Yes	Yes	134.9994	99.9994	9.9999	0.9999	0.1000	0.0199	7/28/10	1340	ATM	28.34	64	77	49	116
Yes	No	134.9996	99.9996	9.9999	1.0000	0.1000	0.0199	7/29	1330	ATM	28.41	64	77	49	115
Yes	NO	134.9995	99.9995	9.9994	1.0000	0.0999	0.0199	7/30	1639	ATM	28.25	64	77	49	116
Yes	No	134.9994	99.9994	9.9999	0.9999	0.0999	0.0199	7/31	1020	ATM	28.29	58	72	42	116
Yes	No	134.9995	99.9994	9.9999	1.0000	0.1000	0.0199	7/31	2005	ATM	28.22	64	77	49	119
Yes	No	134.9996	99.9994	9.9999	0.9999	0.0999	0.0199	8/1	0926	ATM	28.32	56	68	46	116
Ye	NO	184.9996	99.9994	9.9999	1.0000	0.1000	0.0199	8/1	2050	ATM	28.30	61	74	47	117
Yes	Yes	134.9995	99.9994	9.9999	0.9999	0.0999	0.0199	8/2	0759	ATM	28.40	58	70	48	117
yes	no	134.9994	99.9994	9.9999	1.0000	0.1000	0.0199	8/2	1250	SEK	28.37	61	75	46	118
Yes	NO	134.9994	99.9994	9.9999	0.9999	0.1000	0.0199	8/3	1600	JRP	28.34	58	70	48	116
yes	no	134.9996	99.9995	9.9999	1.0000	0.1000	0.0199	8/4	1020	SEK	28.43	54	66	44	118
Yes	NO	134.9994	99.9994	9.9999	1.0000	0.0999	0.0199	8/5	1000	JRP	28.33	56	67	49	119
yes	NO	134.9996	99.9994	10.0000	1.0000	0.1001	0.0199	8/6	11:24	SEK	28.21	58	72	41	119
Yes	YES	134.9995	99.9995	9.9999	0.9999	0.0999	0.0199	8/8	1446	JRP	28.21	60	73	46	118
yes	NO	134.9995	99.9994	9.9999	0.9999	0.1000	0.0199	8/12	16:43	SEK	28.18	56	68	46	117
Yes	NO	134.9994	99.9995	9.9999	0.9999	0.0999	0.0199	8/14	1457	JRP	28.47	58	70	48	116
Yes	No	134.9995	99.9995	9.9999	1.0000	0.1000	0.0199	8/16	0743	ATM	28.41	56	69	46	119

Woodstove Data Sheet 4-4 Scale QC Record Sheet

Scale 2

From: 4/6/10
Through: 7/26/10

Scale: Sartorius
Model: CPA 2245
SN: 24850860
Rev: 5/10

* 135.0000 g ± 100.0000 + 20.0000 + 10.0010 + 5.0000 2010

Level	Recalibrated	135g * Weights	100g Weight	10g Weight	1.0 g Weight	100mg Weight	20 mg Weight	Date	Time	Tech	BP	Wet Bulb	Dry Bulb	% RH	
Yes	No	134.9998	99.9997	9.9999	1.0000	0.0999	0.0199	4/6	1601	ATM		60	75	40	
Yes	No	134.9994	99.9994	9.9999	1.0001	0.1001	0.0199	4/13	0945	ATM		57	70	44	
Yes	No	134.9996	99.9996	10.0000	1.0001	0.1001	0.0199	4/13	1338	ATM		60	72	48	
Yes	Yes	134.9993	99.9993	9.9998	0.9999	0.0999	0.0199	4/14	1445	JRP		59	71	48	
Yes	Yes	134.9994	99.9994	9.9998	0.9999	0.0999	0.0198	4/15	1048	PDB	28.43	58	72	42	
Yes	No	134.9996	99.9994	9.9999	1.0000	0.1000	0.0200	4/22	1455	ATM	28.13	62	75	47	
Yes	No	134.9996	99.9996	9.9999	1.0000	0.1000	0.0199	5/5	1120	ATM	28.43	61	75	44	117
Yes	No	134.9996	99.9995	9.9999	0.9999	0.1000	0.0199	5/7	1600	ATM		59	73	42	122
Yes	No	134.9996	99.9995	9.9999	1.0000	0.0999	0.0200	5/8	1140	ATM	28.28	59	71	48	120
Yes	No	134.9995	99.9994	9.9999	1.0000	0.1000	0.0199	5/11	1349	ATM	28.39	55	68	42	119
Yes	No	134.9995	99.9994	9.9999	0.9999	0.1000	0.0199	5/12	1314	ATM	28.34	60	73	46	120
Yes	No	134.9996	99.9995	9.9999	1.0000	0.1000	0.0199	5/13	1340	ATM	28.37	62	75	47	119
Yes	No	134.9996	99.9995	10.0000	1.0001	0.1001	0.0200	5/14	0630	ATM	28.31	58	71	44	120
Yes	Yes	134.9996	99.9994	9.9998	0.9999	0.1000	0.0199	6/2	1602	ATM	28.09	61	75	46	118
Yes	No	134.9996	99.9995	9.9999	1.0000	0.1000	0.0199	6/22	2041	ATM	28.45	58	70	48	121
Yes	Yes	134.9995	99.9994	9.9999	1.0000	0.1000	0.0199	6/27	1710	ATM	28.29	60	74	43	117
Yes	No	134.9994	99.9994	9.9999	1.0001	0.1010	0.0199	6/29/10	1407	ATM	28.20	61	74	47	119
Yes	No	134.9993	99.9993	9.9998	1.0000	0.1000	0.0198	7/14/10	1640	PDB	28.41	62	75	49	118
Yes	No	134.9997	99.9996	9.9999	1.0000	0.1000	0.0199	7/15/10	1128	ATM	28.43	60	73	46	118
Yes	No	134.9996	99.9995	9.9999	1.0000	0.1000	0.0199	7/16/10	1810	ATM	28.28	61	75	44	117
Yes	No	134.9997	99.9996	9.9999	0.9999	0.0999	0.0199	7/17/10	1800	ATM	28.29	60	73	46	120
Yes	No	134.9996	99.9994	9.9999	1.0000	0.0999	0.0199	7/18/10	2015	ATM	28.25	61	74	47	120
Yes	No	134.9996	99.9995	9.9999	0.9999	0.1000	0.0199	7/19/10	1040	ATM	28.40	60	73	46	119
Yes	No	134.9996	99.9994	10.0000	1.0000	0.1000	0.0199	7/20/10	1810	ATM	28.36	62	75	47	118
Yes	No	134.9996	99.9995	9.9999	0.9999	0.0999	0.0199	7/20/10	1350	ATM	28.36	59	72	45	118
Yes	Yes	134.9995	99.9994	9.9999	1.0001	0.1001	0.0199	7/21/10	1715	ATM	28.22	63	77	45	117
Yes	No	134.9996	99.9994	9.9999	0.9999	0.0999	0.0199	7/22/10	1617	ATM	28.16	61	74	46	119
Yes	Yes	134.9994	99.9994	9.9999	0.9999	0.0999	0.0199	7/26/10	2141	ATM	28.15	62	76	45	121

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

Unit: Kuma V13
Run: EPA 5
Date: 7/20/10
Technicians: AT MYERS
Revised 12/09-Data Sheet #5

Filters

Filter # (front) 52 **Beaker #** 39 **Final Wt.** 53.1553 g
Final Wt. .6681 g **Ml** 55 **Tare Wt.** 53.1510 g
Tare Wt. .6449 g **Desc.** Acetone **Net Wt.** .0043 g
Net Wt. .0232 g

Filter #(Rear) 51 **Beaker #** _____ **Final Wt.** _____ g
Final Wt. .6414 g **Ml** _____ **Tare Wt.** _____ g
Tare Wt. .6421 g **Desc.** _____ **Net Wt.** _____ g
Net Wt. -.0007 g

Acetone Blank Calculation: **Blank Date:** 7/13/10

Blank Beaker # 29 **Final Wt.** 71.5194 g
Ml 50 **Tare Wt.** 71.5193 g
Desc. Acetone **Net Wt.** .0001 g

.0001 g/ 50 ml = .000002 g/ml

Blank Residue Value Calculation:

.000002 g/ml acetone X 55 ml acetone = .00011 g
Blank Residue Value

Total Particulate Catch Calculation:

Filter: .0232 g
Filter: -.0007 g
Beakers: .0043 g - .00011 g = .00419 g
Total Catch **Blank Residue Value**

Total Catch = .002669 g
26.69 mg

Unit: Kuma V.3
Run # EPA 5
Date: 7/20/10
Technician: AM PDG JRP
WST6-Form1, Rev 5/10

Miscellaneous Test Data
Woodstove Data Sheet #8

Useable Firebox Dimensions: See QC Section Useable Volume: 1.554 ft³

Dilution Tunnel Draft (If Applicable): Start: 0.000 Stop: 0.000 Avg: 0.000 in. H_2O

Test Chamber Air Velocity: 10.0 Start: 10.0 Stop: _____ Avg: 10.0 ft./m.

Wet Bulb/ Start: WB: 62 °F DB: 75 °F % Amb Moisture: 1.50 %RH: 47

Dry Bulb Stop: WB: 63 °F DB: 81 °F % Amb Moisture: 1.35 %RH: 35

X Ambient Moisture(%Vol.) = 1.425 % X Relative Humidty (%RH) = 41.0 %

Empty Stove Wt: 329.1 lbs.

Empty Stove Wt with Stack (inc oil seal) Wet: 543.0 lbs. Dry: 543.3 lbs. 544.8

Empty Stove Wt with Stack and Ash Ash: — lbs. Total: 543.3 lbs.

Kindling Wt. Paper: 0.2 lbs. Wood: 2.9 lbs. Total: 3.1 lbs.

Pre Burn Fuel Wt. 8.194 + 8.248 + 8.810 Total: 25.252 lbs.

Total Kindling and Pre Burn Fuel Wt. 28.352 lbs.

Coal Bed Wt-lbs: Range(2.4 - 2.0) 545.7 - 545.3 lbs. Actual: 2.0 lbs.
545.3

Allowable Amount of Charcoal That Can Be Removed:

Coal Bed Wt. Range (2.4 (Upper Wt.) + 2.0 (Lower Wt.) /2) .25 = 0.5 lbs.

Test Fuel Wt-lbs: Ideal 10.9 lbs. Range: 11.9 - 9.8 lbs. Actual: 9.822 lbs.

Test Fuel Size (pcs.) (.75 x 1.5 x 5" Flanges): 14 Pcs. 1.804 lbs.

2 x 4's x 14.125 " 3 Pcs. 6,234 lbs. 63.47 %

4 x 4's x 14.125 " 1 Pcs. 3.590 lbs. 36.53 %

37001

Est. Dry Burn Rate(Kg/Hr.) 9.822 - (9.822 x .16949) X 60/195 = 1.1385
2.2046 Dry Burn Rate (Kg/Hr)

Est EPA Heat Output (HO_E)(Avg BTU's/Hr) (19,140) X 63 x 1.1385 = 13,728
100 EPA Heat Output (HO_E)BTU's/Hr

Unit: Kuma V.3
Run: EPA 5
Date: 7/20/10
Technicians: AM JRP PDG SUK
Data Sheet #9 Rev 6/10 Pg.1

Stove Operating Data
Woodstove Test Data Sheet #9
Cold Start

Fire Started: 0915

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 1.6250" open. At the run setting until start of the test. (2.966" on Rod)

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 bet. In stove for 28 seconds.

Test: Door wide open during loading 1 min 03 sec, then closed,

Primary Air: Wide open from the start of the test (0:00) until 4:30. Adjusted to the run setting of 1.625" open between 4:30 and 5:00. At the run setting of 1.625" 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:

Unit Kuma V.3
Run # EPA 5
Date 7/20/10
Technician AM JRP PUG SGK
Page 1 of 4
WST7-Form2-A, Rev 12/09

Woodstove Operating Data
Woodstove Data Sheet # 9A-1

Wood Data: Kindling: A mix of the below grades

	Size	Mill	Grade	Species
Pre Burn	2X4	Manke Tacoma	Std & BTR, #2	D. Fir Std Grn
Test Fuel	2X4	Manke Tacoma	#2, Std & BTR	D. Fir Std Grn
	4X4	Manke-Tacoma	#1, Std & BTR	D. Fir Std Grn

All grades WCLB Rules Unless otherwise noted

Warm Up Information:
1st Warm Up/Pre Burn Fuel Charge (8.194 lbs) added at 09:32.
2nd Warm Up Pre Burn Fuel Charge (6.248 lbs) added at 10:24.
3rd Warm Up/Pre Burn Fuel Charge (8.010 lbs) added at 11:12.
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 .

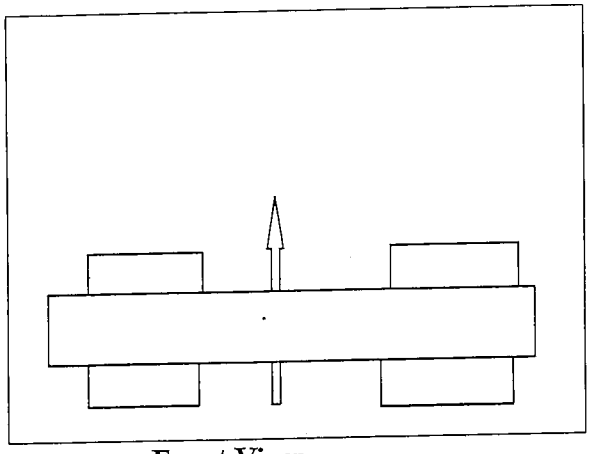
The coals were scooped out of the stove immediately prior to adding the Third pre burn/warm up fuel charge. The stove ~~lost~~ gained 0.3 lbs. 1.5 lbs of hot coals were put back in the stove.

All pre burn/warm up fuel pieces were either 12 or 16 inches long. All pre burn pieces/fuel charges were "ricked" in the stove. The pieces in the bottom layer in each rick contained 2 pieces that were 12 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 4 pieces 16 inches long. The third layer (and fourth layer if present) was loaded flat, perpendicular to the door and contained 2 pieces 16 inches long. The majority of the pieces in each rick were in the second layer. (The loading directions indicate the direction of the longest dimension on each piece relative to the loading door opening.)

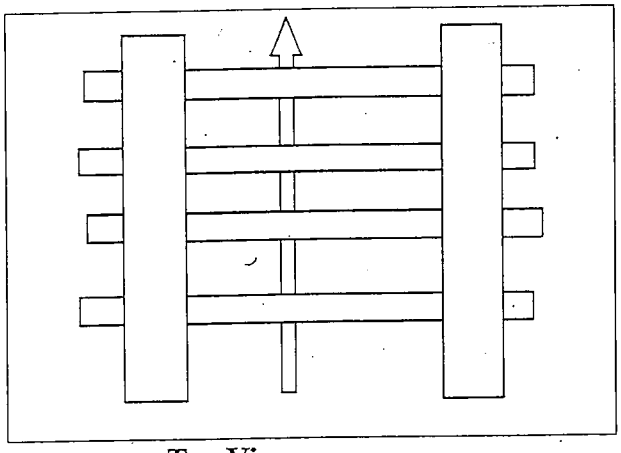
Wood Stove Operating Data
Wood Stove Data Sheet #9A-2

Warm Up Information (cont.):

Each warm up/preburn fuel charge was ricked in exactly (as much as possible) the same manner. The physical arrangement and alignment of the pieces in 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 collapsed or fallen down state) until 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 hot as quickly as possible during the warm up period, thereby maximizing the amount of heat (BTU's) stored in the stove. For this stove, the thermal storage was monitored using the Top (#4) _____ surface temperature (s) and the peak value (s) obtained were 1101 °F



Front View



Top View

The arrows indicate the direction of the air flow through the rick. Note: The top and bottom layers may be offset

The primary air was adjusted to the run setting of 1.6250" (2.966" on Rod.) 2.0 lbs above the upper charcoal bed weight. _____

Unit: Kuma V3
Run #: EPA 5
Date: 7/20/10
Technician: AJM JRP PDG
Page 3 of 4
WST5-Form2, Rev 12/09

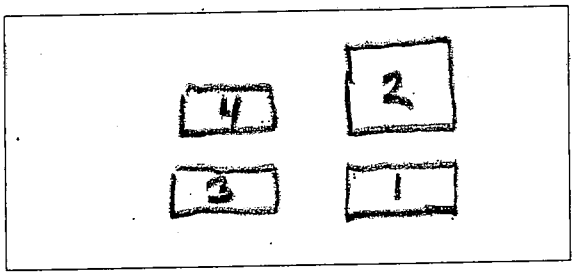
Woodstove Operating Data
Woodstove Data Sheet #9A-3

Additional Comments: Test Start Sequence: (1) Adjusted primary air control to wide open (2) Opened door (3) Loaded test fuel (4) cleaned coals away from in front of the load (5) closed door.

Total Elapsed Time: 1:03
Photo Taken @: 1:35

Test Fuel Charge Loading Information:

Test Fuel Charge and Loading Sequence Diagram



END (Front) of Stove View
4 X 4's: 2
2 X 4's: 1, 3, 4
Loading Sequence: 1, 2, 3, 4
Driest Pcs in Load 1, 3

Loaded the test fuel charge on an essentially level, average sized, Hot coal bed (in appearance, color and temperature) for a Medium Low burn rate.

(1) Load: 1:03 Ignition 0:29 103 closed door
1:04 VC up to baffle.
2:03 Secondaries forward pour front to be on both sides of fuel load.
2:23 Front Tube igniting
3:10 Left front corners of pcs 3 & 4 igniting
3:31 Left front of pieces 1 & 2 igniting
3:45 Full width of front of fuel load igniting
4:30 - 5:00 Primary air control adjusted to the run setting.

WOODSTOVE OPERATING DATA
WOODSTOVE DATA SHEET #9A-4

Additional Comments:

5:00 Maintained a hot pocket of coals between fuel stacks with a VC up to baffle. Front tube flashing on/off.

14.10/2.22 mL Secondaries full width over top of fuel load.

5:57 Secondaries on right side above 1 & 2 decreasing

6:42 13.9/1.26 Gas Balance (Still)

9:15 Secondaries full width of pc 4 to left side of 2. No secondaries over 2, with some secondaries on outside of R. Side of 2 coming forward to front tube.

11:01 15.46/1.27 (Light)

13:30 VC flashing on & off on Right side of 1 & 2

15:29 Air wash secondaries starting on the right ½ of the glass.

16:32 14.52/1.77 (Light)

22:17 Occasional yellow flames off pc 1 secondaries quite orange in color.

14.94/0.97 (L/mL smoke)

Unit: Kuma V.3
Run: EPA 5
Date: 7/20/10
Technician: A.T Mcnew
WST1-Form3-Rev 7/10

Fuel Moisture
Woodstove Test Data Sheet # 10

Room Temperature: 69.0 °F Correction Factor: +0.1 Ohaus Range
Note: Record readings to the nearest 0.1% moisture Scale Check
Uncor Values are corrected for temperature: Yes ____ No ✓ 0.000lb.: 0.000
Time Test Fuel Moisture Readings Taken at: 10:25 1.0 kg = 2.204 lbs
Moisture Meter: Delmhorst Model: J-2000 SN: 34284 5.0 kg = 11.024 lbs
Calibration Checks: 12.0 12.0 MCS-1: 12.7 12.8 23.6 23.8

PC #	Dimen	Use	Top	Bottom	Side	Piece Avg	± Temp Cor.	Piece Avg Corrected	
1	3 pcs	K	8.4	6.3	7.8	7.5	+0.1	7.600	
2									
3									
4	2X4-8'	P	20.5	19.5	19.5	19.833	+0.1	19.933	
5	"	"	19.4	21.9	22.1	21.133	"	21.233	
6	"	"	22.8	23.1	21.9	22.600	"	22.700	
7	↓	↓	20.1	21.7	20.3	20.700	↓	20.800	
8								84.666	
9									
10	2X4-14.125"	T	19.0	20.0	19.9	19.633	+0.1	19.733	1.416
11	"	"	19.3	20.2	21.1	20.200	"	20.300	1.546
12	↓	↓	19.7	22.8	22.4	21.633	↓	21.733	1.940
13									
14	4X4-14.125"	T	20.5	18.6	20.2	19.767	+0.1	19.867	3.316
15								81.633	
16									
17	5X1.5X.75	T	21.5	22.3	22.8	22.200	+0.1	22.300	1.604
18	(Spacers)							OUT Spacers	
19									
20									

	Kindling	Pretest Fuel	Test Load
% Moisture – Dry Basis:	7.600 %	21.1665 %	20.40825 %
% Moisture – Wet Basis:	7.063 %	17.4689 %	16.949 %

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

Acceptable Ranges: 16-20% wet; 19-25% dry

Key For Use: K= Kindling P= Pretest Fuel T= Test fuel

180 Pieces = 1.2334
178 " = 1.2472

4X4
3.500 36.53

3.700 kg

1, 8.194 lbs 7 pcs
2, 8.248 " "
3, 8.810 " 6 pcs
T. 9.822 lbs

Unit: Kuma V.3
Run#: EPA 5
Date: 7/20/10
Technician: ATM

WOOD DENSITY DETERMINATION
WOODSTOVE TEST DATA SHEET #11

WST2-form11-Rev 6/90

2x4

Wood Piece: Nominal Dimensions: 3 5/16 x 3 7/16 x 1.5"

Depth (D): 3.825 cm

Width (W): 8.7925 cm

Length (L): 8.430 cm
8.490 cm
8.460 cm
8.455 cm

Length $\bar{X}$ = 8.45875 cm

Volume: 284.479 cm^3
(D X W X L)

MOISTURE: Room Temperature: 69 °F Correction Factor: +0.1

Uncorrected Meter Readings Corrected for temperature: Yes ___ No ✓

NOTE: Record moisture meter readings to the nearest 0.5%

	Uncor	Cor
Top:		19.3 %
Bottom:		21.2 %
Side:		18.7 %
$\bar{X}$:		19.733 % +0.1

Avg % Moisture (Dry) 19.833 %

Aug % Moisture (Wet) 16.467 %

Scale: Leveled In ✓ Out ✓

Zeroed: In ✓ Out ✓

Wet Weight: 162.9 g Dry Weight: 140.5 g

% Moisture Dried Basis: 13.751 % ✗
[1 - (Dry Wt ÷ Wet Wt)] X 100

	Date	Time	Temp
Into Dryer	7/20/10	1327	196 °F
Out of Dryer	7/29/10	1123	202 °F

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

Density = 140.5 g (dry wt) ÷ 284.479 cm^3 (volume) = 0.4939 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

Preburn Start Wt. 2.0 Lbs. Up 547.7 lbs.
Test Start Wt Range 545.7 - 545.3 lbs.
Baro. Pressure 28.36 ↓ "Hg

Pre Burn Data
Record Sheet #13

Unit: Kuma V.3 Date: 7/20/10
Run: EPA 5 Technician(s): ATM JZP PDG
Page: 1 of 1 WST2-Form 16, Rev 12/09

Hot Box On 13 ✓ 17 ✓

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 [redacted]	11 Room Temp	Static		Comments
0	1135	547.7	0.0	545	1084	656	608	657	492	1153	1529	82	-.079		Did not Rake, Primary Air Set At 1.625" open
5	40	547.0	.7	4785	1044	666	607	664	500	1148	1444	81	-.073		2.966" on Rod, Secondary Air Set At FIXED
10	45	546.7	.3	434	981	675	604	671	510	1103	1350	82	-.068		Fan: OFF - FCT ✓
15	50	546.3	.4	400	906	679	604	669	520	1107	1292	81	-.066		Tunnel on at: 26 min.
20	55	546.1	.2	373	852	679	613	666	524	1104	1207	82	-.060		Buckets Iced ✓
25	1200	546.0	.1	335	757	670	618	655	528	1043	1076	80	-.056		Analyzers Spanned ✓
30	05	545.9	.1	326	726	664	614	647	530	1018	1041	81	-.054		Pumps Turned on at: 47 min
35	10	545.8	.1	311	681	651	606	634	531	993	1011	80	-.051		620.6 ΔT — ΔΔT
40	15	545.7	.1	301	648	638	598	620	533	972	988	80	-.050		607.4 -13.2
45	20	545.6	.1	292	620	624	588	607	534	946	966	80	-.048		594.6 -12.8
50	25	545.5	.1	284	601	614	581	597	534	927	948	80	-.045		585.4 -9.2
55	30	545.4	.1	276	579	601	572	584	532	902	938	80	-.045		Tunnel ΔP 573.6 -11.8
X														X	Probe In Tunnel
60	1235	545.3	.1	270	550	586	552	566	530	873	924	80	-.043		✓ 556.8 -16.8
65															
70															
75															
80															
85															
90															
95															
100															Start 520-525
105															
110															
115															

Myren C)lting Inc Data Sheet P1 of 4 Unit Kuma V.3 Date 7 / 20 / 10 Run E1 5

Test End .545 . 3 ΔT 556 Barometric Pressure 28.35 ig 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	Stack Temp #3	Stack Static Press
0	1235	555.1	9.8	0	.269	6.70		13.68	.103	1.03	6.5				270	-.043
05	40	554.3	9.0	.8	.399	9.90		10.23	.154	1.54	6.4		ML		495	-.070
10	45	553.6	8.3	.7	.496	12.26		8.06	.109	1.09	(1.3)	Bal	L	Bal 6:40	408	-.066
15	50	552.9	7.6	.7	.546	13.53		6.72	.130	1.30	10.4		n		411	-.066
20	55	552.1	6.8	.8	.575	14.24		5.75	.182	1.82	(7.8)	O/B	L→ML	out	413	-.066
25	1300	551.4	6.1	.7	.605	14.98		4.94	.196	1.96	7.6		ML		414	-.066
30	05	550.7	5.4	.7	.623	15.43		4.55	.184	1.84	8.3		M	stacking	414	-.066
35	10	550.0	4.7	.7	.696	17.23		2.44	.246	2.46	7.0		M→ML		418	-.066
40	15	549.4	4.1	.6	.630	15.60		4.23	.215	2.15	7.3		ML	Bal 41:19	413	-.065
45	20	548.9	3.6	.5	.571	14.14		6.22	.107	1.07	(13.2)	Bal	wisps		391	-.063
50	25	548.4	3.1	.5	.571	14.14		6.60	.031	.31	45.6		clear		386	-.061
55	30	548.1	2.8	.3	.549	13.60		7.17	.025	.25	54.4		"		371	-.059
Total															(4604)	(-.757)

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 #13	C Gas Impgr #14	Part. Filt. #15	Part. Cond. #16	17	18
0	1235	550	586	552	566	530	873	924	80	97	209	36	74	52	219	35
05	40	621	579	511	561	520	821	1039	80	115	219	37	78	38	245	35
10	45	747	571	477	552	517	774	1199	81	107	230	38	82	37	234	35
15	50	810	565	443	540	515	801	1196	80	105	226	38	83	37	220	35
20	55	830	564	426	533	509	833	1225	80	105	220	38	84	37	217	35
25	1300	840	567	420	534	503	864	1295	81	106	217	38	85	37	237	35
30	05	855	572	419	539	497	886	1331	80	106	214	38	85	37	243	36
35	10	870	579	423	545	491	914	1330	82	107	210	38	85	37	228	36
40	15	886	588	428	552	488	938	1400	82	107	213	37	84	37	216	36
45	20	868	596	437	560	484	982	1392	81	105	216	37	83	37	215	36
50	25	854	601	444	567	481	1033	1384	82	105	214	38	83	37	228	36
55	30	822	604	455	579	482	1047	1332	81	103	211	38	82	37	237	36
Total		(9553)	(6972)	(5435)	(6628)	(6017)	(10766)	(15047)	(970)							

Myren C sulting Inc Data Sheet P2 of 4 Unit Kuma V.13 Date 7 / 20 / 10 Run EPA 5

Test End Wt. 545.3 ΔT 556.8 Barometric Pressure 28.32 "hg Gas Flows @ 1.5" Technician(s) AM JRP 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	1335	547.8	2.5	.3	.537	13.31		7.48	.023	.23	57.9	clear				366	-.058
65	40	547.5	2.2	.3	.505	12.52		8.21	.034	.34	36.8	"				345	-.056
70	45	547.3	2.0	.1	.481	11.93		8.81	.032	.32	37.3	"				339	-.054
75	50	547.1	1.8	.2	.384	9.53		11.17	.039	.39	24.4	"				316	-.051
80	55	546.9	1.6	.2	.309	7.68		12.78	.088	.88	(8.7)	Light - Out of bal				306	-.050
85	1400	546.8	1.5	.1	.272	6.77		13.50	.126	1.26	5.4	clear				286	-.046
90	05	546.8	1.5	0	.286	6.38		14.01	.103	1.03	6.2	"				276	-.044
95	10	546.7	1.4	.1	.259	6.45		13.92	.105	1.05	6.1	"				264	-.043
100	15	546.6	1.3	.1	.256	6.38		14.00	.105	1.05	6.1					259	-.041
105	20	546.5	1.2	.1	.251	6.25		14.11	.108	1.08	5.8					253	-.040
110	25	546.4	1.1	.1	.248	6.18		14.14	.116	1.16	5.3					248	-.040
115	30	546.4	1.1	0	.253	6.30		14.00	.119	1.19	5.3					242	-.038
Tot																(3500)	(-.561)

M5G-2

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	~~Tube 1~~ Hot box #17	~~Tube 2~~ Pump. #18	Tube 3 #19	H_2O H box #20
60	1335	812	604	462	585	483	1032	1307	82	102	211	38	82	37	235	36		
65	40	774	604	478	592	484	1057	1245	82	101	213	38	82	37	229	36		
70	45	758	602	487	595	486	1041	1261	82	101	218	38	82	37	221	36		
75	50	721	598	495	595	488	986	1179	82	100	221	37	82	37	220	36		
80	55	697	595	493	593	489	952	1037	82	99	220	37	82	37	224	36		
85	1400	639	585	485	583	492	911	960	81	98	218	37	82	37	227	36		
90	05	609	576	479	571	494	874	929	82	99	218	37	82	37	229	36		
95	10	578	565	473	557	495	850	911	81	98	218	37	82	37	228	36		
100	15	559	557	469	546	496	831	900	82	98	219	38	82	38	226	36		
105	20	537	547	464	533	498	815	883	81	96	221	37	82	38	226	36		
110	25	524	540	460	523	497	802	868	82	97	223	37	82	38	226	36		
115	30	508	531	455	512	495	787	863	81	97	222	37	82	38	227	36		
Tot		(7716)	(6904)	(5700)	(6785)	(5897)	(10938)	(12343)	(980)									

Myren C ulting Inc Data Sheet P3 of 4 Unit Kuma V Date 7 / 20 / 10 Run EPA 5

Test End wt. 545.3 ΔT 556 Barometric Pressure 28.30 "hg Gas Flows @ 1.5" Technician(s) ATM JRP & CSO

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	1435	546.3	1.0	.1	.257	6.25		14.03	.124	1.24	5.0					239	-.037
125	40	546.2	.9	.1	.246	6.13		14.12	.130	1.30	4.7					234	-.036
130	45	546.2	.9	0	.241	6.01		14.23	.133	1.33	4.5					233	-.036
135	50	546.1	.8	.1	.242	6.03		14.17	.139	1.39	4.3					228	-.035
140	55	546.0	.7	.1	.239	5.96		14.26	.137	1.37	4.3					226	-.035
145	1500	546.0	.7	0	.235	5.86		14.36	.136	1.36	4.3					226	-.034
150	05	545.9	.6	.1	.228	5.69		14.50	.143	1.43	4.0					225	-.034
155	10	545.8	.5	.1	.234	5.84		14.32	.149	1.49	3.9					224	-.033
160	15	545.8	.5	0	.232	5.79		14.37	.149	1.49	3.9					223	-.032
165	20	545.7	.4	.1	.231	5.76		14.39	.150	1.50	3.8					222	-.032
170	25	545.6	.3	.1	.231	5.76		14.32	.163	1.63	3.5					221	-.031
175	30	545.6	.3	0	.228	5.69		14.40	.162	1.62	3.5					219	-.031
Tot																2720	-.406

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	~~Cont 2nd~~ #17	~~Tube 1~~ #18	~~Tube 2~~ ΔT #19	~~Tube 3~~ ΔΔT #20
120	1435	501	527	452	506	493	780	857	82	97	221	38	82	38	227	37		
125	40	487	518	448	496	490	766	842	81	97	219	37	82	38	226	36		
130	45	481	515	445	492	488	757	826	82	96	217	37	82	38	224	37		
135	50	472	508	443	483	485	746	820	82	97	216	37	83	38	224	36		
140	55	467	504	440	479	484	734	818	82	98	217	37	83	38	222	37		
145	1500	461	500	437	474	482	725	803	82	99	219	37	84	38	222	36		
150	05	457	497	435	470	482	727	792	82	99	221	37	84	38	225	37		
155	10	451	491	432	464	480	732	793	83	100	223	37	85	38	229	37	4636	-98.2
160	15	456	486	430	461	478	730	765	83	100	223	37	85	38	230	37		
165	20	441	481	426	457	476	722	783	82	100	222	37	86	38	227	37	4566	-100.2
170	25	437	477	426	455	473	714	779	82	100	222	37	86	38	224	37		
175	30	434	472	427	453	470	717	772	82	101	221	37	87	38	222	37	4512	-105.6
Tot		5545	5976	5245	5690	5781	8850	9670	985									

Myren Consulting Inc Data Sheet P4 of 4 Unit KUMA V.2 Date 7/20/10 Run EPA5 G CSO

Test E Wt. 5453 ΔT 556.8 Barometric Pressure 28.2 "hg Gas Flows @ 1.5" Technician(s) ATM SAP

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	1535	545.5	12	1	.229	5.71	14.37	14.37	.164	1.64	3.5					216	-.030
185	40	545.5	12	0	.226	5.69		14.38	.166	1.66	3.4					217	-.031
190	45	545.4	11	1	.225	5.61		14.45	.166	1.66	3.3					216	-.030
195	50	545.3	01	1	.217	5.42		14.66	.165	1.65	3.3					215	-.030
200																(866)	(-.121) Page total
205																(11890)	(-1.845) total ÷40 AVG
210																(297)	(-.046)
215																	
220																	
225																	
230																	
235																	
Tot																	

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	~~Cont. 2nd~~ #17	~~Tube 1~~ #18	Tube 2 #19	Tube 3 #20
180	1535	430	469	429	450	466	720	766	82	101	220	37	87	38	222	37		
185	40	426	465	431	448	462	715	761	82	101	219	37	87	38	223	37		
190	45	425	462	433	446	458	710	757	82	101	219	37	87	38	224	37		
195	50	422	458	433	444	454	718	761	82	101	219	37	88	38	225	37		
200		(1705)	(1854)	(1726)	(1788)	(1840)	(2863)	(3047)	(328)									
205		(24519)	(21706)	(18106)	(20891)	(19535)	(33417)	(40107)	(3263)									
210		(613)	(543)	(453)	(522)	(488)	(835)	(1003)	(82)									
215																		
220															Start	556.8		
225															Stop	442.2		
230															ΔT	-114.6		
235																		
Tot																		

(Total ÷40 AVG)

Pre and Post Test Zero/Span Check
Woodstove Data Sheet # 15-1

Site: Myren Consulting, Colville, WA Date: 7/20/10 Analyte: CO_2

Source: Kuma V3 Run #: EPA 5

Zero Cyl #: AA-9167 Conc. 00.0 % CO_2 Cyl Press: 2002 psi

Certified By: Oxarc Date: 5/11/09

Span Cyl #: SX-45410 Conc. 12.6 % CO_2 Cyl Press: psi

Certified By: Mathesom Tri Gas Date: 4/12/10

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 Values= 25.0% CO_2

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

Pre Run Audit: By: JRP Time: 1151 Temp: 81 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	0.00	0.000	0.0665	+0.0665	+0.27
Span	50.0	.500	12.5	50.0	.504	12.4926	- 0.1074	-0.85

Comments:

Post Run Audit: By: AT Myren Time: 1642 Temp: 91 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	00.0	00.0	00.0	.001	.0912	+0.0912	+0.36
Span	50.0	.500	12.5	50.5	.505	12.5173	- 0.0827	-0.66

Comments:

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

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

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

Pre and Post Test Zero/Span Check
Woodstove Data Sheet # 15-3

Site: Myren Consulting, Colville, WA Date: 7/20/10 Analyte: CO

Source: Kuma U,3 Run #: EPA 5

Zero Cyl #: AA-9167 Conc. 00.0 % CO Cyl Press: 2002 psi

Certified By: Oxarc Date: 5/11/09

Span Cyl #: SY-45410 Conc. 2.55 % CO Cyl Press: _____ psi

Certified By: Matheson TRI GAS Date: 4/12/10

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

Range: 0 - 10.0% CO (0 – 5.0% CO) Analyzer Output: 0 – 1.0 v.

Flow: 1.5 SCFH Measured By: Rotameter: X Flowmeter: _____

EPA Span Values= 5.0% CO

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

Pre Run Audit: By: JRP Time: 1151 Temp: 81 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	0.000	0.000	.00716	+0.00716	+0.14
Span	2.55	.255	2.55	2.55	.255	2.5004	-0.04964	-1.95

Comments:

Post Run Audit: By: AT Myr Time: 1642 Temp: 81 °F

Audit Results

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
Zero	00.0	.000	00.0	0.00	.000	.00716	+0.00716	+0.14
Span	2.55	.255	2.55	2.49	.249	2.4417	-0.1083	-4.25

Comments:

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

Zero % Difference(Δ%) = (Act % (ppm) – Exp % (ppm)) / Full Scale Value X 100

Span % Difference (Δ%)= (Act % (ppm) – Exp % (ppm)) / Exp % (ppm) X 100

Unit: Kuma U.3
Run: EPA 5
Date: 7/20/10
Technicians: ATM JRP PDC
WST6-Form3, Rev 12/09

Quality Checks
Woodstove Data Sheet #16

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

Thermocouple Check (at ambient): T/C # 1: — °F; T/C#2: 67.6 °F
T/C # 3: 68.3 °F; T/C # 4: 69.8 °F; T/C #5: 70.5 °F;
T/C # 6: 70.1 °F; T/C # 7: 70.5 °F; T/C # 8: 70.1 °F;
T/C # 9: 70.6 °F; T/C # 10: 70.8 °F; T/C # 11: 62.3 °F;
T/C # 12: 67.6 °F; T/C # 13: 67.1 °F; T/C # 14: 65.1 °F;
T/C # 15: 67.7 °F; T/C # 16: 68.1 °F; T/C # 17: 67.4 °F;
T/C # 18: 635 °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	Adj	Post Test Check	%Difference
(0°F): 0.4 °F	to: — °F	Zero (0°F): 1.1 °F	+0.24
Span	Adj	Span	
(2000°F): 2001.2 °F	to: — °F	(2000°F): 2003.2 °F	+0.13

(Allowable % Difference = 1.5%. Use Formulas on Woodstove Data Sheet #15 to calculate % Difference, % Difference calculated in degrees absolute.)

Thermocouple Readout Pretest Linearity Check

0°F = 0.8 °F; 200°F = 202.3 °F; 400°F = 399.7 °F
600°F = 602.0 °F; 800°F = 802.3 °F; 1000°F = 1001.6 °F
1200°F = 1199.3 °F; 1400°F = 1400.3 °F; 1600°F = 1600.9 °F
1800°F = 1801.2 °F; 2000°F = 2001.4 °F

Combustion Gas (CO_2, O_2, CO) Train Leak Check: Pre OK JRP Post OK PDC
Draft (Static) Guage Zero Check: Pre ~~OK~~ ATM Post OK PDC
Scale Check Pre (Wt, #'s): 548.0 − 543.0 = 5.0 lbs / 5.0 Lbs = OK JRP
Post (Wt, #'s): 550.1 − 545.1 = 5.0 lbs / 5.0 lbs = OK ATM

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
1) Panther	4466459	1000 X .1 lb	Ø	Ø	
	PASS.....FAIL		100.0	100.0	
NOTES:			500.0	500.0	
0.0 = 0.0	600.0 = 600.0		1000.0	1000.0	
50.0 = 50.0	650.0 = 650.0		Ø	0	
100.0 = 100.0					
200.0 = 200.0			XXXXX	XXXXXX	XXXXX
300.0 = 300.0					
400.0 = 400.0					
500.0 = 500.0					
2)					
	PASS.....FAIL				
NOTES:					

ADDITIONAL COMMENTS:

LAST CHECKED: **NEXT CHECK DUE:** 6-98

WGHTS CERTIFIED: 6-96 **TECHNICIAN:** Paul Fischer

Calibration checked IAW NIST handbook 44

Becherini Scale Center, Inc.
317 E. Sprague
Spokane, WA 99202

SCALE CALIBRATION RECORD

Customer: MYREN Consulting | Date: 3/15/10

Work Order Number: 45096 | PO Number:

Equipment Mfg.	Serial Number	Specifications	Weight used	Initial Readings	Final Readings
1. PANTHER	4466459	1000 x .1	Φ	Φ	0
	(Pass)..Fail		50	49.9	50.0
			100	98.8	100.0
			300	299.8	300.0
			500	499.9	500.0
			Φ	Φ	0

Notes: Calibrated

Equipment Mfg.	Serial Number	Specifications	Weight used	Initial Readings	Final Readings
2. PANTHER	00155556CH	5K x 1	Φ	Φ	
	(Pass)..Fail		50	50	
			100	100	
			300	300	
			500	500	
			Φ	Φ	

Notes:

Equipment Mfg.	Serial Number	Specifications	Weight used	Initial Readings	Final Readings
3. PANTHER	00025736AJ	1000 x .1 Lb	Φ	Φ	
	(Pass)..Fail		50	50.0	
			100	100.0	
			300	300.0	
			500	500.0	
			Φ	Φ	

Notes:

Equipment Mfg.	Serial Number	Specifications	Weight used	Initial Readings	Final Readings
4. OHAUS	2350003	24 x .002	Φ	Φ	
RANGER	(Pass)..Fail		1	1.000	
			5	5.000	
			15	15.000	
			24	24.000	
			Φ	Φ	

Notes:

Additional Comments:

Last Checked: 9/09 | Next Check Due: 9/10

Weights Certified: 11/08 | Technician: JCC

Calibration checked IAW NIST handbook 44

Established 1974

QUALITY CONTROL SERVICES

LABORATORY EQUIPMENT • SALES • SERVICE • CALIBRATION • REPAIRS
2340 SE 11TH Ave. Portland, Oregon 97214 • Box 14831 Portland, Oregon 97293
(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com

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 #33577 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.

'echnician Signature: D. Coleman **Date:** 9-6-10

'echnician Signature: _____ **Date:** _____

PTID: MYRC02

Rewm Scale Set Up & Calibrated for Side by Side Weighing

33577

Quality Control Services

Report of Services and Calibration

2340 S.E. 11TH AVENUE
PORTLAND, OR 97214
PHONE 503-236-2712

Sold To: Myren Consulting — PT ID: MYRC02
Address: 512 Williams Lake Road
City: Colville, WA 99114
Ship To: 512 Williams Lake Road Colville, WA 99114

P.O. No: X VERBAL
Contact: Mr. Ben Myren
Phone: 509-685-9458
Email: bmyren@pcix.com

No	Item	Make	Model	Serial Number	Location	Contact	Rate	Date Svc'd	Tech	Cust ID
1	Balance	Sartorius	CP224S	17050374	Lab	Ben Myren	$115.00	4-6-20		
2	BLANCER	SARTORIUS	CPA224S	15C7924	LAB	"	M/C			
3										
4										
5										
6										
7										
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22										
23										
24										
25										

Service / Calibration Documentation Requirements

- [X] Certificate of Calibration
- [ ] Calibration with Data
- [ ] A2LA Certificate

Received By: X Ben Myren Date:

Comments: X Ben Myren

No.	Description	Part #	Qty.	@	Amt.	No.	Description	Part #	Qty.	@	Amt.

ARTS

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.

:REN CONSULTING, INC.
>12 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: 3 May 2010
TECHNICIAN: AT Myers

T/C #	Location	Ice Water Bath (° F)	Boiling Water (° F)
1.	Wet Bulb	33	208
2.	Dry Bulb	34	208
3.	Stack	34	209
4.	Stove Top	34	209
5.	Left Side	33	208
6.	Back	33	209
7.	Right Side	34	209
8.	Bottom	34	209
9.	Firebox	33	209
10.	2nd Burn/ Cat	33	209
11.	Ambient	34	208
12.	Tunnel	34	208
13.	C Gas Hot Box	34	209
14.	C Gas Impinger Exit	33	208
15.	Particulate Filter #1	34	208
16	Condenser #1	33	208
17.	Particulate Filter #2	33	208
18.	Condenser #2	34	209
19.	Extra	33	209
20.	Extra	34	209
21.	Extra	33	209

Thermocouples checked against

Reference Thermometer #: ERTCO CAT 1005-3FC CAT 817 SN 1647
Ice Water Bath: 32 °F
Boiling Water: 99.2°C=210.6 °F
Room Temp: 64 °F
BP: 27.98 " Hg

POLY
#PV

K&M Company
TORRANCE, CA 90503

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

Model K2100F Serial No. Serial # 177533

T. Kuecker
Calibration Technician

31 Aug 95
Factory Calibration Date

ALTEK INDUSTRIES CORP
210 Commerce Drive, Rochester, NY 14623 USA
(716) 334-3720 FAX (716) 334-6673
800-32-ALTEK
800-322-5835
Anywhere in USA

YREN 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: 3 May 2010
TECHNICIAN: A.T. Myren

Thermocouple Readout Manufacturer: Omega

Model #: 4108-K Serial #: 99110582 Type: K Range: 0-2000° F

Location: T/C Dial # 1 Digicator

Calibrated with: Altek

As found: 0° F = 0.5 Adjusted to: 0.0
2000.0 ° F = 2000.9 Adjusted to: 2000.0

		% Dif			% Dif			% Dif
0 =	0.0	0	800 =	802.0	-0.16	1600 =	1600.6	-0.03
100 =	97.9	+0.38	900 =	899.3	+0.05	1700 =	1699.4	+003
200 =	202.2	+0.33	1000 =	1001.1	-0.08	1800 =	1800.5	-0.02
300 =	298.3	+0.22	1100 =	1098.9	+0.07	1900 =	1899.1	+0.04
400 =	399.9	+0.01	1200 =	1199.4	+0.04	2000 =	2000.1	-0.00004
500 =	499.2	+0.08	1300 =	1298.9	+0.06	___ =	___	___
600 =	601.6	-0.15	1400 =	1400.2	-0.01			
700 =	699.2	+0.07	1500 =	1499.8	+0.01			

$$\%\ Dif = \frac{(\text{Reference Temperature } °F + 460) - (\text{Readout Temperature } °F + 460)}{\text{Reference Temperature } °F + 460}$$

Or

$$\%\ Dif = \frac{(\text{Reference Temperature } °C + 273) - (\text{Readout Temperature } °C + 273)}{\text{Reference Temperature } °C + 273}$$

YREN CONSULTING, INC.
612 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: 3 MAY 2010
TECHNICIAN: Art Myran

Thermocouple Readout Manufacturer: Omega

Model #: DP15KF Serial #: 448744 Type: K Range: 0-1900°F

Location: 45G-P Meter Box

Calibrated with: Altek

As found: 0° F = 001 Adjusted to: —
1900° F = 1898 Adjusted to: —

		% Dif			% Dif			% Dif
0 =	1	-0.22	800 =	799	+0.08	1600 =	1599	+0.05
100 =	97	+0.54	900 =	899	+0.07	1700 =	1698	+0.09
200 =	201	-0.15	1000 =	1001	-0.07	1800 =	1799	+0.04
300 =	299	+0.13	1100 =	1098	+0.13	1900 =	1898	+0.08
400 =	398	+0.23	1200 =	1198	+0.12	2000 =		
500 =	499	+0.10	1300 =	1299	+0.06		=	
600 =	599	+0.09	1400 =	1398	+0.11			
700 =	698	+0.17	1500 =	1498	+0.10			

$$\% \text{ Dif} = \frac{(\text{Reference Temperature } °F + 460) - (\text{Readout Temperature } °F + 460)}{\text{Reference Temperature } °F + 460}$$

Or

$$\% \text{ Dif} = \frac{(\text{Reference Temperature } °C + 273) - (\text{Readout Temperature } °C + 273)}{\text{Reference Temperature } °C + 273}$$

YREN CONSULTING, INC.
612 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: 3 May 2010
TECHNICIAN: N.T. Myers

Thermocouple Readout Manufacturer: JENCO

Model #: 768-K-F-02 Serial #: 900167 Type: K Range: 0-2000 °F

Location: IN Meter Box 511-M

Calibrated with: Altek Model K2100 E SN 177535

As found: 0° F = 001 Adjusted to: —
2000° F = 1996 Adjusted to: —

		% Dif			% Dif			% Dif
0 =	1	-0.22	800 =	801	-0.08	1600 =	1617	-0.93
100 =	97	+0.97	900 =	902	-0.15	1700 =	1713	-0.60
200 =	201	-0.15	1000 =	1006	-0.41	1800 =	1808	-0.35
300 =	298	+0.26	1100 =	1107	-0.45	1900 =	1904	-0.17
400 =	396	+0.47	1200 =	1211	-0.66	2000 =	1997	+0.08
500 =	495	+0.52	1300 =	1313	-0.74	___ =	___	___
600 =	598	+0.19	1400 =	1415	-0.81			
700 =	697	+0.27	1500 =	1516	-0.82			

$$\% \text{ Dif} = \frac{(\text{Reference Temperature } °F + 460) - (\text{Readout Temperature } °F + 460)}{\text{Reference Temperature } °F + 460}$$

Or

$$\% \text{ Dif} = \frac{(\text{Reference Temperature } °C + 273) - (\text{Readout Temperature } °C + 273)}{\text{Reference Temperature } °C + 273}$$

Woodstove Data Sheet # 55
Revision 0 12/18/01

THERMOMETER CALIBRATION DATE: 5/9/10 TECHNICIAN: A.J. Myren

MANUFACTURER:	ERTCO	ERTCO	Fisher	Taylor	Taylor	Premium	
CAT #.	1005-3EC	517	ASTM 59F	1330 N/A	1330 N/A	—	
SERIAL NO.	1697	KBS-173	AD4544	—	—	—	
RANGE:	-1 to 101°C	0-200°C	0-180°F	20-120°F	20-120°F	0-220°F	
GRADUATIONS:	0.1°C	1.0°C	1.0°F	1°F	1°F	2°F	
TYPE:	Tube	Tube	Tube	Tube	Tube	Dial	
TEMP. POINT 1	2.8	3	38	38	39	40	
2	9.3	10	50.0	51	51	52	
3	20.9	22	72	73	74	75	
4	34.9	36	96	96	96	97	

Lowest (density)

Sling Psychrometer

COMMENTS:

$°F = (°C \times 9/5) + 32$
$°C = (5/9)(°F - 32)$

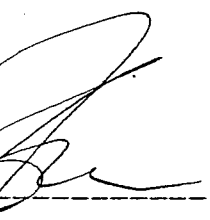
R E P O R T O F C A L I B R A T I O N

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
NIST IDENTIFICATION NO. 88024



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

Revised 1/10

Dry Gas Meter Calibration Data

Date: 3 May 2010 Technician: SEK 1ATM

Calibration Meter Mfr: Rockwell SN: 10522102 Y: 0.9978

Meter Box ID 45G-P Meter Mfr: Rockwell SN: 3039270

Electrical Check ok Pitot Leak Check N/A

Leak Check Front Half ok Back Half ok

BP = 27.98 in. Hg

Orifice (Δh) in. H_2O		Gas Volume			Temperature			Time (Θ), Min.
		Cal. Meter (Vc), (cu.ft.)	Dry Gas Meter (Vm), (m^3)(ft^3)		Cal. Meter (Tc), °F	Dry Gas Meter Inlet (Tmi), °F / °C	Dry Gas Meter Outlet (Tmo), °F °C	
.8	initial	608.000	135.539	initial	64.5 63	80 82		10:06
	final	613.065	140.673	final	62.5	82		10:00
	total	5.0650	5.1340	avg.	63.3	81.3		
.9								
	initial	613.200	140.808	initial	64.5 62.5	80 83		9:23
.9	final	618.235	145.914	final	62.5	83		9.38
	total	5.0350	5.1060	avg.	63.2	82		
1.00								
	initial	618.300	145.983	initial	64.5 62.5	80 82		8:56
1.0	final	623.383	151.146	final	63	82		8.93
	total	5.0830	5.1630	avg.	63.3	81.3		
1.20								
	initial	623.800	151.555	initial	64.5 63.5	80 83		8:06
1.20	final	628.962	156.797	final	64	83		8.10
	total	5.1620	5.2420	avg.	64	82		
2.00								
	initial	629.500	157.351	initial	63.5 63.5	82 83		6:15
2.00	final	634.584	162.473	final	64.5	82		6.25
	total	5.0840	5.1220	avg.	63.8	82.3		

$$Y = \frac{(Y)(Vc)(Pb)(Tm + 460)}{(Vm)(Pb + \Delta h/13.6)(Tc + 460)} \qquad \Delta h@ = \frac{(0.0317)(\Delta h)}{Pb(Tmo + 460)} [(Tc + 460)(\Theta)] / [(Vc)(Yc)]^2$$

METER BOX: 45G-P
DATE: 5/3/10
PAGE: 2 OF 3

$$Y = \frac{(Y_c)(V_c)(Pb)(T_m + 460)}{(V_d)(Pb + \Delta H/13.6)(T_c + 460)} =$$

$Y = \frac{(.9978)(5.0650)(27.98)(81.3 + 460)}{(5.1349)(27.98 + .80/13.6)(63.3 + 460)}$ (541.3, 523.3) $= \frac{76543.565}{75329.726} = 1.01611$

$Y = \frac{(.9978)(5.0350)(27.98)(82 + 460)}{(5.1060)(27.98 + .90/13.6)(63.2 + 460)}$ (542, 523.2) $= \frac{76188.596}{74924.216} = 1.01688$

$Y = \frac{(.9978)(5.0830)(27.98)(81.3 + 460)}{(5.1639)(27.98 + 1.00/13.6)(63.3 + 460)}$ (541.3, 523.3) $= \frac{76815.586}{75794.967} = 1.01347$

$Y = \frac{(.9978)(5.1620)(27.98)(82 + 460)}{(5.2420)(27.98 + 1.20/13.6)(64 + 460)}$ (542, 524) $= \frac{78110.334}{77098.053} = 1.01313$

$Y = \frac{(.9978)(5.0840)(27.98)(82.3 + 460)}{(5.1220)(27.98 + 2.00/13.6)(63.8 + 460)}$ (542.3, 523.8) $= \frac{76972.635}{75462.187} = 1.02002$

Y FACTOR	VARIATION (± 0.02 ALLOWED FROM AVERAGE Y)
1.01611	-.00019
1.01688	-.00096
1.01347	.00245
1.01313	.00279
1.02002	-.00410

Avg Y 1.01592

METER BOX 45G-P
DATE 5/4/10
Page 3 of 3

$$\Delta H@ = \frac{(0.0317)(\Delta H)}{(Pb)(T_{mo} + 460)} \cdot \left[\frac{(T_w + 460)(\Theta)}{(Y_c)(V_c)}\right]^2 =$$

$$\Delta H@ = \frac{(0.0317)(.80^{\checkmark})}{(27.98^{\checkmark})(81.3^{\checkmark} + 460)_{541.3}} \cdot \left[\frac{(63.3^{\checkmark} + 460)(10.10^{\checkmark})}{(.9978^{\checkmark})(5.0650^{\checkmark})}\right]^2 = 1.8313^{\checkmark}$$

$$\Delta H@ = \frac{(0.0317)(.90^{\checkmark})}{(27.98^{\checkmark})(82^{\checkmark} + 460)_{542}} \cdot \left[\frac{(63.2^{\checkmark} + 460)(9.38^{\checkmark})}{(.9978^{\checkmark})(5.0350^{\checkmark})}\right]^2 = 1.7952^{\checkmark}$$

$$\Delta H@ = \frac{(0.0317)(1.0^{\checkmark})}{(27.98^{\checkmark})(81.3^{\checkmark} + 460)_{541.3}} \cdot \left[\frac{(63.3^{\checkmark} + 460)(8.93^{\checkmark})}{(.9978^{\checkmark})(5.0830^{\checkmark})}\right]^2 = 1.7768^{\checkmark}$$

$$\Delta H@ = \frac{(0.0317)(1.20^{\checkmark})}{(27.98^{\checkmark})(82^{\checkmark} + 460)_{542}} \cdot \left[\frac{(64^{\checkmark} + 460)(8.10^{\checkmark})}{(.9978^{\checkmark})(5.1620^{\checkmark})}\right]^2 = 1.7033^{\checkmark}$$

$$\Delta H@ = \frac{(0.0317)(2.0^{\checkmark})}{(27.98^{\checkmark})(82.3^{\checkmark} + 460)_{542.3}} \cdot \left[\frac{(63.8^{\checkmark} + 460)(6.25^{\checkmark})}{(.9978^{\checkmark})(5.0840^{\checkmark})}\right]^2 = 1.7402^{\checkmark}$$

ΔH@	VARIATION (± 0.20 ALLOWED)
1.8313 ✓	-.0619 ✓
1.7952 ✓	-.0258 ✓
1.7768 ✓	-.0074 ✓
1.7033 ✓	.0661 ✓
1.7402 ✓	.0292 ✓

AVG ΔH@ 1.7694 ✓

Post Test
Meter Box Audit
Woodstove Data Sheet #32

MSG-1

Unit: Kuma V3
Date: 7/30/10
Technician: SEK / ADM
WST9-Form2, Rev 1/10

Meter Box Calibration Audit
Test Data

Run #	1	2	3	4	5	6	7	8	9	10
Avg.ΔH	0,90	.9	.9	.9	.9					
Max Vac	0	0	0	0	0					

Avg. Test Series Δ H:_____ in H_2O. Test Series Max Vac:_____ in Hg

Audit Dry Gas Meter Mfr: Rockwell SN: 1052202 Correction Factor (Y): .9978
Test Dry Gas Meter Mfr: Rockwell SN:_____ Correction Factor (Y): 1.0159

Audit Data

		Audit #1	Audit #2	Audit #3
BP ("Hg):		28.38	28.38	28.39
Vac("Hg):		0	0	0
Audit Meter:	Final Vol	684.866	689.984	695.173
	Initial Vol	679.687	684.870	690.101
	Vol (Vc, Ft^3)	5.1790	5.114	5.0720
Audit Meter:	Initial	65.5	67.5	68
Temp (°F) (Tc)	Mid	66.5	68	63
	Final	66 (illegible)	67	63
	Avg (°F/°A)	66 (526)	67.5 (527.5)	64.7 (524.7)
Δ H (In. H_2O)	Initial	.90	.90	.90
	Mid	.90	.90	.90
	Final	.90	.90	.90
	Avg	.90	.90	.90
Dry Gas Meter:	Final Vol	901.056	906.206	911.452
	Initial Vol	895.974	901.066	906.303
	Vol(V_d)(ft^3)(m^3)	5.0820	5.140	5.149
Dry Gas Meter	Initial	66	70	73
Temp (°F) : Inlet	Mid	69	72	76
(Tm:)	Final	69	73	77
	Avg(°F/°A)	68 (528)	71.7 (531.7)	75.3 (535.3)
Dry Gas Meter	Initial			
Temp (°F) : Outlet	Mid			
(Tm:)	Final			
	Avg(°F/°A)			
Avg Dry Gas Meter Temp (Tm - °F/°A)		68 (528)	71.7 (531.7)	75.3 (535.3)
Time (minutes)		9:51	9:41	9:48

Note: If volume is in m^3, multiply by 35.314667 to obtain ft^3.
Note: Add 460° to all temperatures

$Y = \frac{(V_c)(MCF)(BP)(T_m)}{(V_d)(BP + \Delta h/13.6)(T_c)}$

Y Factor % Difference = $\frac{Act - Exp}{Exp}$ X 100

Kumm V.3 7/30/10

Note: MCF = Meter Correction Factor (Y) for Dry Gas Meter used as a Transfer Standard

Run 1

$Y = \frac{(5.1790)(.9978)(28.38)(528)}{(5.0820)(28.38 + .90/13.6)(526)} = \frac{77,434.7186}{76,040.3846} = 1.01834$

$\Delta\% = \frac{(1.01834 - 1.01688)}{1.01688} \times 100 = +0.144\ \%$

Run 2

$Y = \frac{(5.114)(.9978)(28.38)(531.7)}{(5.140)(28.38 + .90/13.6)(527.5)} = \frac{76,998.6791}{77,127.5406} = .99833$

$\Delta\% = \frac{(.99833 - 1.01688)}{1.01688} \times 100 = -1.824\ \%$

Run 3

$Y = \frac{(5.0720)(.9978)(28.39)(535.3)}{(5.149)(28.39 + .90/13.6)(524.7)} = \frac{76910.4550}{76,879.4914} = 1.0004$

$\Delta\% = \frac{(1.0004 - 1.01688)}{1.01688} \times 100 = -1.62\ \%$

Note: The Y Factor % Difference must be < ±5.0% to be acceptable. Avg. Δ%= −1.100

Determination of Interpolated Y Factor for Average Certification Test Series Δ H from Dry Gas Meter Calibration Data:

0.90 (A) inch H_2O Δh= 1.01688 (C) Calculated Calibration Y Factor (from Calibration)

____ (B) inch H_2O Δ h = ____ (D) Calculated Calibration Y Factor (from Calibration)

(B) − (A) = ____ X100 = ____ (E) (D) − (C) = ____ / (E) = ____ (F)

Avg Δ h − (A) = ____ X 100 = ____ (G)

$\left(\frac{\text{(F)}}{} \times \frac{\text{(G)}}{}\right) + \text{(C)} =$ Interpolated Y Factor For Avg. Test Series Δ h

Dry Gas Meter Back Half Leak Check: ____ inch H_2O in One Minute

Front Half Leak Check — Meter Reading — Leak Rate

Meter	Vac In. Hg	Start	Stop	cmm	cfm
DGM	−16.5	.2325	.233		
TM	−16.5	.976	.9765		

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	1.0026

Calibration Conditions			
Date	Time	8-Jan-10	8:15
Barometric Pressure		29.60	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		
	DGM Input	Volume	Volume	Volume	Outlet Temp	Outlet Temp	Volume	Volume	Volume	Outlet Temp	Outlet Temp		Calibration Factor		Flowrate
Elapsed	Pressure	Initial	Final	Sample	Initial	Final	Initial	Final	Sample	Initial	Final		Previous	Current	Std & Corr
(Θ)	(P_m)	(V_{mi})	(V_{mf})	(V_m)	(t_{mi})	(t_{mf})	(V_{wi})	(V_{wf})	(V_m)	(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	-5.0	180.672	188.032	7.360	71.6	71.6	931.500	938.660	7.160	71	71		0.9940	0.9862	1.174
												Variation	0.79%	must be less than 1.5%	
10.00	-2.2	188.032	193.725	5.693	71.6	71.6	938.660	944.260	5.600	71	71		1.0047	0.9902	0.551
												Variation	1.44%	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 Eric Weber Date 1/8/10

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

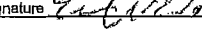
Calibration Conditions			
Date	Time	3-Dec-07	11:00
Barometric Pressure		29.6	in Hg
Calibration Technician		EW	
DGM Serial Number		1052202	

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_{mi})	(V_{mf})	(t_{mi})	(t_{mf})	(V_{wi})	(V_{wf})	(t_{wi})	(t_{wf})	(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  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 uses a Delmhorst J-2000 which was calibrated daily using the "Check" feature. Then the operation of the moisture meter was checked with a Delmhorst Moisture Content Standard Model MCS-1 at 12.6 and 23.8%. 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. If Delmhorst #496 insulated pins are used, the meter is set at 222 using the Set Pin Calibration instructions. The meter is set at 1 for the Species correction. 1 is the setting for D. Fir

Delmhorst Instrument Co.
J-2000 Quick Reference Guide

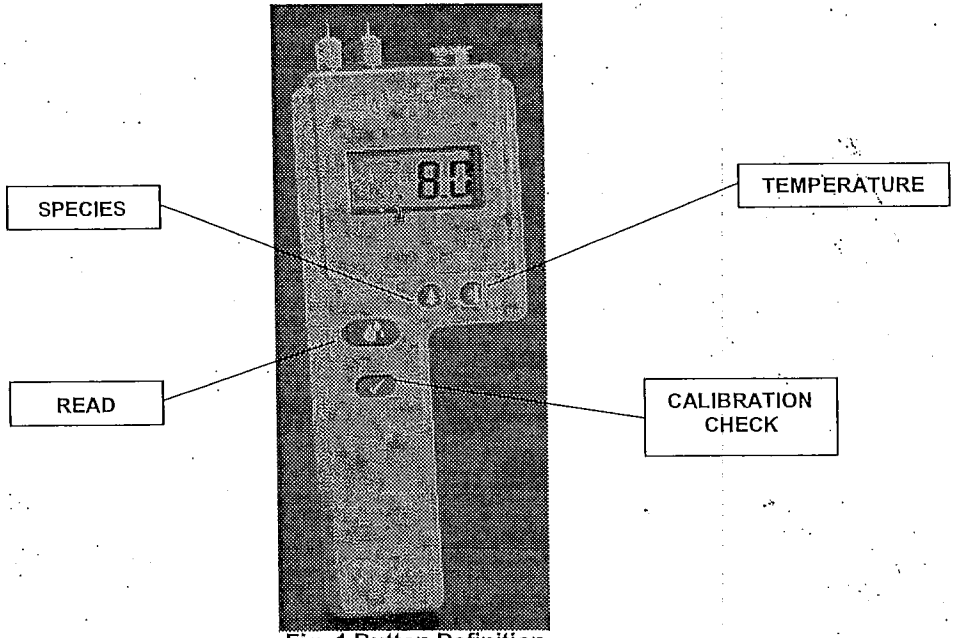


Fig. 1 Button Definition

GETTING STARTED

1. Set the wood species by holding down the **SPECIES** button until the desired scale number is displayed. The default species setting is #1 Douglas Fir (see **Species Code Chart** for a full listing).
2. Align the contact pins parallel to the grain and push them to their full penetration into the wood and press the **READ** button. The meter displays the %MC for two seconds.

SET TEMPERATURE

1. Temperature correction is necessary if the wood temperature is outside the range of 50°F (10°C) to 90°F (32°C).The default temperature setting is 70°F.
2. To increase the temperature value, hold the **TEMPERATURE** button until the desired temperature value is displayed.
3. To decrease the temperature value, press and release the **TEMPERATURE** button then hold the **SPECIES** button within one second. Hold the **SPECIES** button until the desired temperature value is displayed.
4. To change between Fahrenheit and Celsius press and release the **TEMPERATURE** button and within one second press the **CALIBRATION CHECK** button and release when you are in the mode needed.

SET PIN CALIBRATION

1. To change between insulated and un-insulated pin setting, press and release the **SPECIES** button, then press the **CALIBRATION CHECK** button within one second to cycle between 222 for insulated and 444 for un-insulated pins (the default setting is un-insulated).

CHECK CALIBRATION

1. Press the **READ** button and the **CALIBRATION CHECK** button simultaneously.
2. Meter is in calibration if it displays 12% (+ or - .2).
3. Make sure the pins are not in contact with anything when checking the calibration.

REVIEW ACCUMULATED READINGS

1. The meter will accumulate up to 100 readings.
2. To view the readings press and release the **CALIBRATION CHECK** button. The meter displays the number of accumulated readings, then the average of those readings, then the highest stored reading.
3. To erase readings hold the **CALIBRATION CHECK** button down for 5 seconds. All accumulated readings will be erased and the meter will display "0".

RESET METER

1. Press and release the **CALIBRATION CHECK** button.
2. Within one second press the **SPECIES** button.
3. Default settings will be restored (Species #1 Douglas Fir and 70°F temperature). The meter will display 170.
4. Any previously stored readings will be erased.

Delmhorst Instrument Co.
51 Indian Lane East
Towaco, NJ 07082
Ph: 1877-DELMHORST (877) 335-6467
Fax: 973-334-2657
Web Site: www.delmhorst.com

510INS-0003/QR
10/07

WOODSTOVE DATA SHEET #26-A

CEM GAS TRAIN RESPONSE TIME

PRE CERTIFICATION TEST SERIES CHECK

Date 2010	5/9	5/9	5/9	5/9	5/9	5/9					
Technicians	AFM	AFM	AFM	AFM	AFM	AFM					
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	0.378	.377	.376	.143	.145	.147					
15	.378	.376	.376	.143	.146	.147					
30	.062	.061	.059	.046	.046	.048					
45	.032	.031	.030	.032	.033	.035					
60	.015	.015	.014	.010	.011	.012					
75	.012	.011	.011	.006	.007	.008					
90	.010	.009	.008	.003	.004	.005					
105	.006	.005	.005	.003	.003	.003					
120	.003	.003	.003	.002	.002	.003					
135	.002	.002	.002	.001	.002	.002					
150	.002	.001	.001	.001	.001	.002					
165	.001	.001	.001	.001	.001	.001					
180	.001	.001	.001	.001	.000	.000					
Initial Response Time (Seconds)	N 24	N 24	N 25	N 30	N 30	N 30					
95% Response Time (Seconds)	> 45 < 60	> 45 < 60	> 45 < 60	> 60 < 75	> 60 < 75	> 60 < 75					
Analyzer Flow Rate 1.5 SCFH	→	→	→	→	→	→					

Comments

Pre burn

Myren Consulting Inc.
512 Williams Lake Rd; Colville, WA 99114; (509)685-9458
QA WS, REV 1/10

CO_2 Analyzer

Multipoint Calibration Report Form

Site: Myren Lab, Colville, WA Date: 7/13/2010

Analyzer: Make: Horiba Model: PIR 2000 SN: 607204

Calibration by: A.T. Myren

Cal Gas Flow: 1.5 scfh Measured by: Rotameter: X Mass Flowmeter: _____

BP: 28.26 "Hg Instrument ID: Princo

Temp: 64.5 °F Instrument ID: Omega Digicator

Analyzer Last Calibrated: 4/26/2010 By: A.T. Myren

Cylinders:

1. # AA-9167 Concentration: 0.00 %CO_2 Cyl. Press.: 2000 psi.
   Certified By: Oxarc Date: 5/11/10
2. # SX-45410 Concentration: 12.6 %CO_2 Cyl. Press.: 1610 psi.
   Certified by: Matheson Tri Gas Date: 4/12/10
3. # 250-1175 Concentration: 21.0 %CO_2 Cyl. Press.: 0820 psi.
   Certified by: Oxarc Date: 8/22/97
4. # SX-40585 Concentration: 6.04 %CO_2 Cyl. Press.: 1870 psi.
   Certified by: Matheson Tri Gas Date: 4/12/10

Analyzer: Calibrated Range: 0 – 25 % Output: 0 – 1.0 v.

Flow: 1.5 scfh Measured by: Rotameter: X Mass Flowmeter: _____

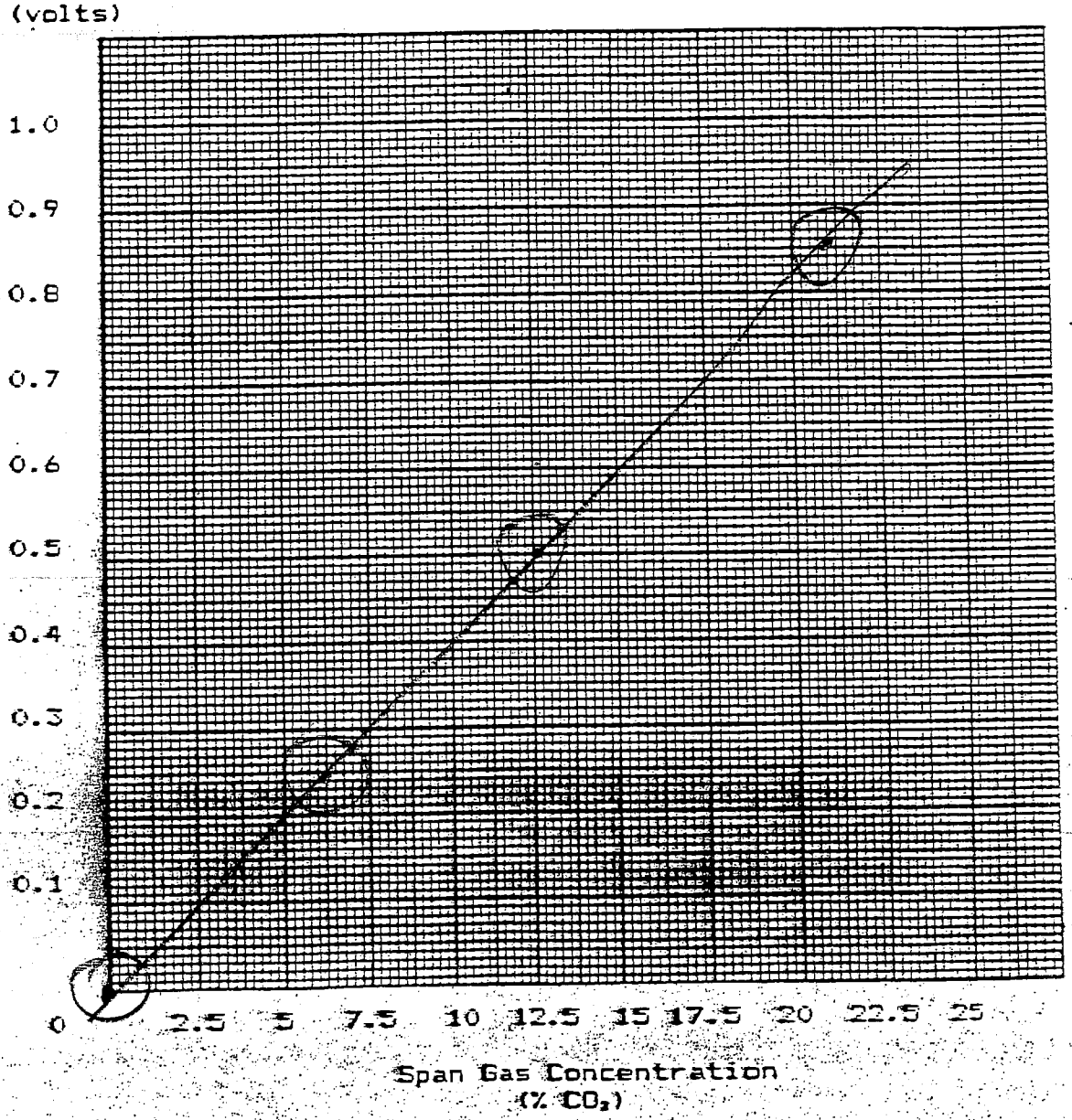
Calibration Results

Point #	Cyl. #	% CO_2	Expected		Actual		Adj.		% Dif.	Curve Conc.	Potentiometer	
			Meter	DVM	Meter	DVM	Meter	DVM			Unadj.	Adj.
1	1	0.00	0.00	.000	0.00	.000	—	—	+.27	0.067		—
2	2	12.6	50.4	.504	50.5	.504	—	—	-0.85	12.493		—
3	3	21.0	84.0	.840	85.5	.852			+0.34	21.072		
4	4	6.04	24.2	.242	24.0	.241			-0.052	6.008		
5	1	0.00	0.00	.000	0.00	.000			+.27	0.067		

Comments: 0.500 = 12.3989759
.504 V = 12.4925952
.852 V = 21.0724821
.241 V = 6.00837 04
.000 V = 0.0665523

Linear Regression Results:

Y = MX + B
Slope (M) = 0.0405583
Y Intercept (B) = -0.0026627
Correlation Coefficient (r) = 0.9999544



Comments

Pre Lumm

Myren Consulting Inc.
512 Williams Lake Rd; Colville, WA 99114; (509)685-9458
QA WS, REV 1/10

CO Analyzer

Multipoint Calibration Report Form

Site: EPA Lab, Colville, WA Date: 7/13/2010

Analyzer: Make: Horiba Model: MEXA 311-GE SN: GE-30075

Calibration by: A. T. Myren

Cal Gas Flow: 1.5scfh Measured by: Rotameter: X Mass Flowmeter:

BP: 28.28 "Hg Instrument ID: Princo

Temp: 64.5 °F Instrument ID: Omega Digicator

Analyzer Last Calibrated: 4/26/10 By: A. T. Myren

Cylinders:

1. # AA-9167 Concentration: 0.00 %CO Cyl. Press.: 2000 psi.
   Certified By: Oxarc Date: 5/11/10
2. # SX-45410 Concentration: 2.55 %CO Cyl. Press.: 1610 psi.
   Certified by: Matheson Tri Gas Date: 4/12/10
3. # 350-1175 Concentration: 4.03 %CO Cyl. Press.: 820 psi.
   Certified by: Oxarc Date: 8/22/97
4. # SX-40585 Concentration: 1.29 %CO Cyl. Press.: 1870 psi.
   Certified by: Matheson Tri Gas Date: 4/12/10

Analyzer: Calibrated Range: 0 - 5.0 % Output: 0 – 1.0 v.

Flow: 1.50 CFH Measured by: Rotameter: X Mass Flowmeter:

Calibration Results

Point #	Cyl. #	% CO	Expected		Actual		Adj.		Curve Conc.	% Dif.	Potentiometer	
			Meter	DVM	Meter	DVM	Meter	DVM			Unadj.	Adj.
1	1	0.00	0.00	0.00	0.00	.000	—	—	.0072	+0.03		—
2	2	2.55	2.55	.255	2.56	.255	—	—	2.500	-1.95		—
3	3	4.03	4.03	.403	4.15	.414			4.055	+0.62		
4	4	1.29	1.29	.129	1.33	.133			1.308	+1.36		
5	1	0.00	0.00	.000	0.00	.000			.0072	+0.03		

Comments: 0.500 = 4.895785026
0.255 = 2.500859000
0.414 = 4.064941913
0.133 = 1.307535929
0.000 = .0071622 78

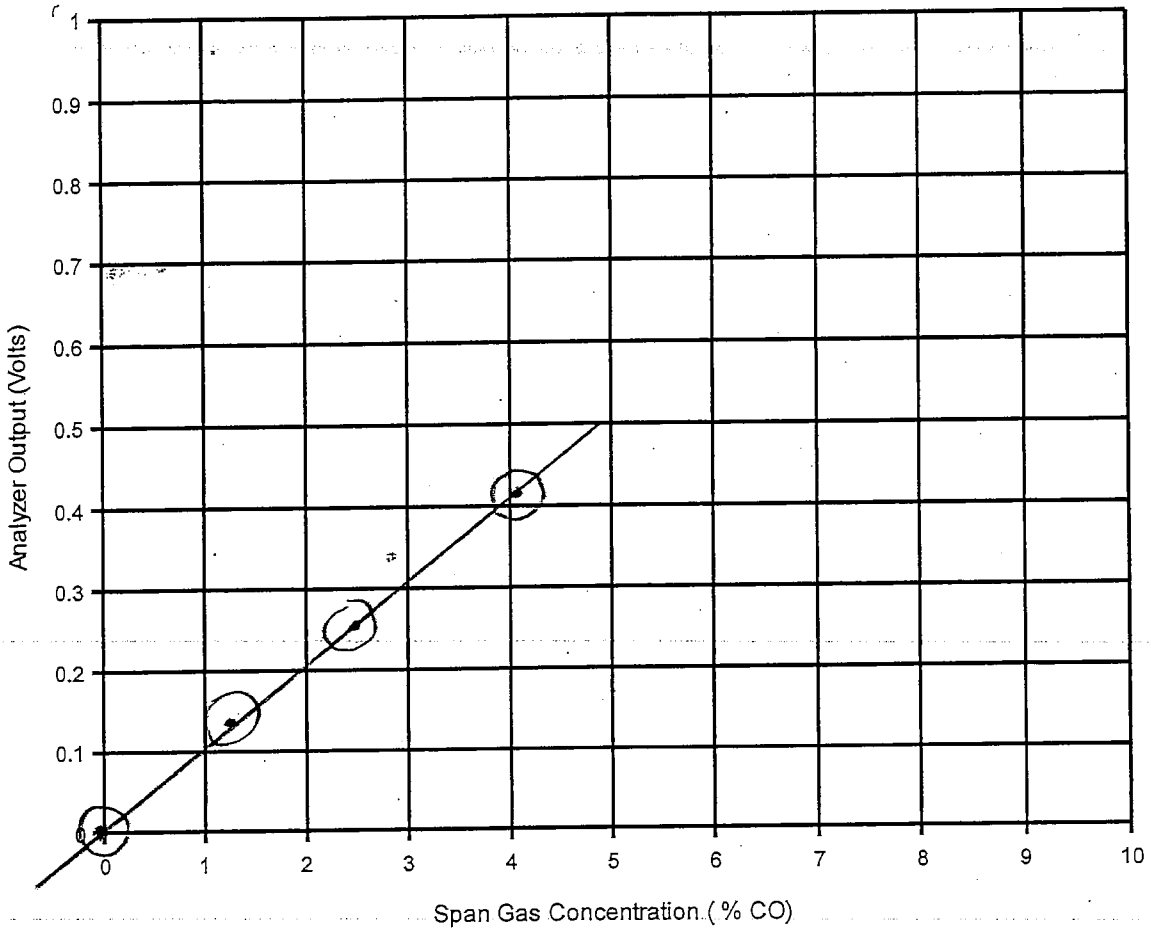
Linear Regression Results

Y= MX + B

Slope M = 0.1022388

Y Intercept (B)= -0.0006549

Correlation Coefficient (r) = 0.998069



Comments:

MATHESON TRI•GAS
ask - The Gas Professionals™
1650 Enterprise Parkway
Twinsburg, Ohio 44087
215-648-4000

Certificate of Analysis - EPA Protocol Mixtures

Customer: OXARC INC
Cylinder Number: SX-45410
Cylinder pressure: 1600 psig
Last Analysis date: 4/9/2010
Expiration Date: 3/18/2013

Protocol:	Reference #	Lot #
G1	519323	109-96-17642

DO NOT USE THIS CYLINDER WHEN THE PRESSURE FALLS BELOW 150 PSIG

REPLICATE RESPONSES

Component:	Oxygen	Date: 3/18/2010	Date:
Certified Conc:	12.5% ± 1% REL	12.5%	
		12.5%	
		12.5%	
Component:	Carbon Dioxide	Date: 3/18/2010	Date:
Certified Conc:	12.6% ± 1% REL	12.6%	
		12.6%	
		12.5%	
Component:	Carbon Monoxide	Date: 4/2/2010	Date: 4/9/2010
Certified Conc:	2.55% ± 1% REL	2.57%	2.55%
		2.56%	2.54%
		2.56%	2.54%

BALANCE GAS: Nitrogen

REFERENCE STANDARDS

Component:	Oxygen	Carbon Dioxide	Carbon Monoxide
SRM #:	NTRM-82658	SRM-2745	SRM-2641a
Sample #:	01110212	9-C-32	52-D-15
Cylinder #:	SX-20658	CAL-016125	CAL-017008
Concentration:	10.09%	15.633%	4.009 %

CERTIFICATION INSTRUMENTS

Component:	Oxygen	Carbon Dioxide	Carbon Monoxide
Make/Model:	Rosemount 755	Varian 3800 GC	Varian 3800 GC
Serial Number:	2002832	LR-92489	LR-92489
Measurement Principle:	Paramagnetic	TC, FID	TC, FID
Last Calibration:	2/26/2010	3/16/2010	4/2/2010

Notes: T134744

This certification was performed according to EPA Traceability Protocol for Assay & Certification of Gaseous Calibration Standards September 1997, using procedure G1 and/or G2.

Analyst Philip D. Mott Date 4/12/2010

MATHESON
TRI•GAS
ask. . .The Gas Professionals™

Certificate of Analysis - EPA Protocol Mixtures

1650 Enterprise Parkway
Twinsburg, Ohio 44087
215-648-4000

Customer: OXARC INC
Cylinder Number: SX-40586
Cylinder pressure: 1600 psig
Last Analysis date: 4/9/2010
Expiration Date: 3/18/2013

Protocol:	Reference #	Lot #
G1	519323	109-96-17643

DO NOT USE THIS CYLINDER WHEN THE PRESSURE IS BELOW 150 PSIG

REPLICATE RESPONSES

Component:	Oxygen	Date: 3/18/2010	Date:
Certified Conc:	5.98% ± 1% REL	5.98% 5.98% 5.99%	
Component:	Carbon Dioxide	Date: 3/18/2010	Date:
Certified Conc:	6.04% ± 1% REL	6.03% 6.07% 6.01%	
Component:	Carbon Monoxide	Date: 4/2/2010	Date: 4/9/2010
Certified Conc:	1.29% ± 1% REL	1.30% 1.30% 1.30%	1.29% 1.28% 1.29%

BALANCE GAS: Nitrogen

REFERENCE STANDARDS

Component:	Oxygen	Carbon Dioxide	Carbon Monoxide
SRM #:	NTRM-82658	SRM-1674b	SRM-2639a
Sample #:	01110212	7-F-05	54-D-51
Cylinder #:	SX-20658	CAL-014611	CAL-013889
Concentration:	10.09%	6.876 %	0.991 %

CERTIFICATION INSTRUMENTS

Component:	Oxygen	Carbon Dioxide	Carbon Monoxide
Make/Model:	Rosemount 755	Varian 3800 GC	Varian 3800 GC
Serial Number:	2002832	LR-92489	LR-92489
Measurement Principle:	Paramagnetic	TC, FID	TC, FID
Last Calibration:	2/26/2010	3/16/2010	4/2/2010

Notes: T134744

This certification was performed according to EPA Traceability Protocol for Assay & Certification of Gaseous Calibration Standards September 1997, using procedure G1 and/or G2.

Analyst Phil D. Mat. Date 4/12/2010

WELDING PRODUCTS
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FIRE EQUIPMENT

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4003 E. BROADWAY
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FAX (509) 535-0368

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7815 W. LEMHI ST.
(208) 376-0377
FAX (208) 376-1133

COEUR D'ALENE, ID 83814
3530 RAMSEY RD.
(208) 765-3311
FAX (208) 667-5974

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FAX (509) 684-6742

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FAX (509) 925-1136

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McNARY HIWAY
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FAX (503) 567-2265

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800 W. COLUMBIA DR.
(509) 582-4202
FAX (509) 586-9859

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2513 3RD. AVE., NORTH
(208) 743-6571
FAX (208) 746-8374

MOSES 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
729 COMMERCIAL AVE.
(208) 734-9711
FAX (208) 734-7923

WENATCHEE, WA 98801
OHME GARDENS RD.
(509) 662-8417
FAX (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 _____ Date 8/25/97
Travis Auger

Comments:

STOVE QC

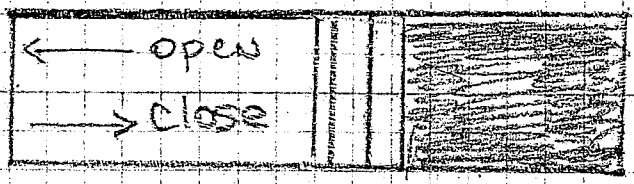
The Kuma Aspen noncatalytic wood heater is a small to medium sized stove with a useable firebox volume of 1.55 cubic feet. It has several distinguishing features. They are as follows:

1. The unit is specifically designed with a 3.00" 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: 1.75"
2. Horizontal Throat Dimension: 1.50
   Note: The vertical and horizontal throat dimensions are measured at the front edge of the baffle.
3. Air Wash Gap: 0.21875" (7/32")
4. Minimum Primary Air Setting: 1.4375". See drawing on page 4 of 4 in this Section.
5. Lower Primary Air Orifice - N/A
6. Lower Primary Air Orifice - Outlet Orifice: 1-0.1875" hole
7. Secondary Air Tubes
   Front: 34 7/64" holes on 1/2" centers
   Middle Front: 34-3/32" holes on 1/2" centers
   Middle Rear: 34-3/32" holes on 1/2" centers
   Rear: 34-3/32" holes on 1/2" centers
8. Combustion Air Inlet Orifice (Outside Air Hookup): 3.00" diameter hole.
9. Secondary Air Inlet Orifice: 1.75" X 0.75"
10. (Adjustable) Primary Air Inlet Orifice: 1.00" X 4", of which 1.4375" is always open.

Kuma Aspen Primary Air Settings



shaded area is always open

Run 2 (Low) at Stop - 1.4375" open

Run 5 (M. Low) 1.625" open

Run 3 (M. Low) 1.875" open

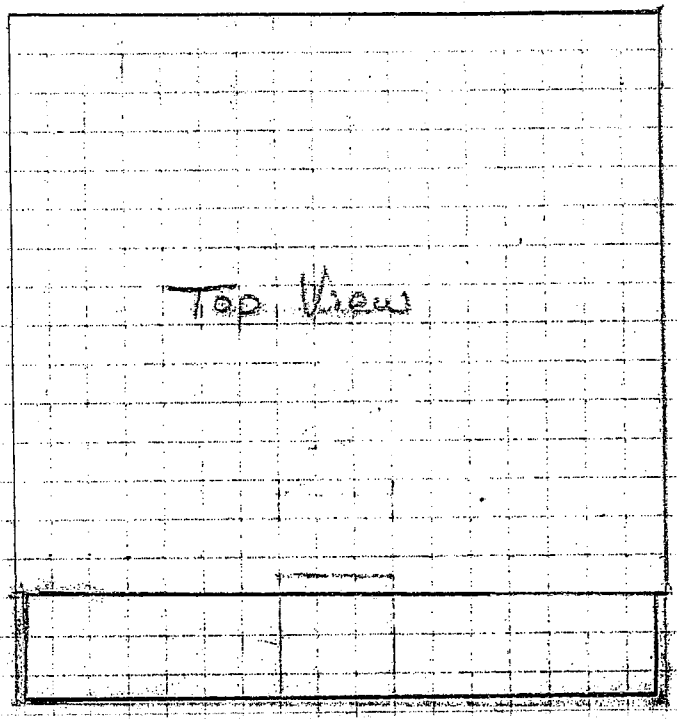
Run 4 (M. Hi) 2.00" open

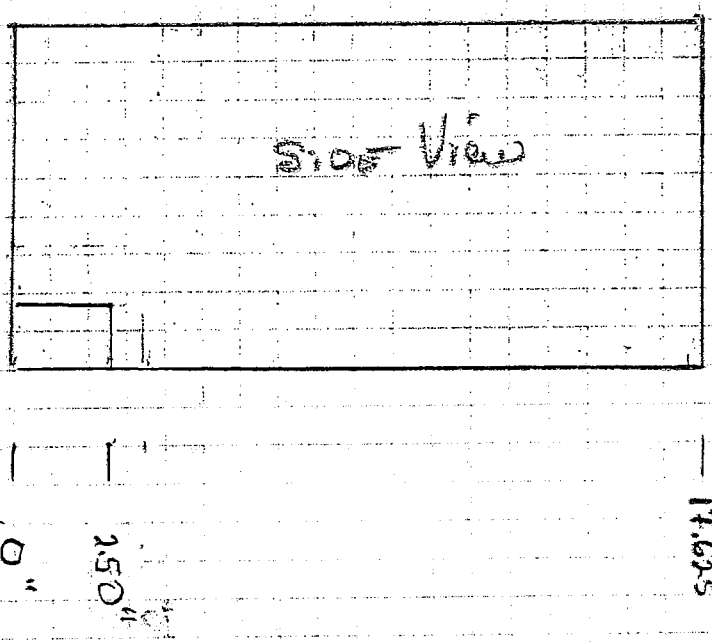
Run 1 Wide Open High

AST. Myers
9/23/10
NO Scale

KUMA V.3

USEABLE FIREBOX DIMENSIONS





A.T. Myrew

Not to Scale

8/20/10

Kuma V.3
8/20/10 A.T. Myren
P. 2 of 2

Useable Firebox Volume Calculations

$17" \times (17.625" - 25") \times 9" =$ 2314.125 ✓

$16.875 \times 25 \times 9 =$ 379.688 ✓

$1.5 \times 1.25 \times 17 =$ 31.875 ✓

2725.688 in^3

− 39.551 in^3

2686.137 in^3

Less

Bottom Duct

$2.5 \times .9375 \times 16.875 = 39.551\ in^3$

$2686.137\ in^3 \div 1728\ in^3/ft^3 = 1.554\ ft^3$

Useable Firebox Volume

Fuel Load Calculations

$1.554\ ft^3 \times 7 lbs/ft^3 = 10.881$ lbs. Ideal Fuel Load Weight

Fuel Load Weight Range

$10.881 \pm (0.10 \times 10.881) = 11.969 = 11.9$ lbs

$= 9.793 = 9.8$ lbs.

Maximum Fuel Piece Length

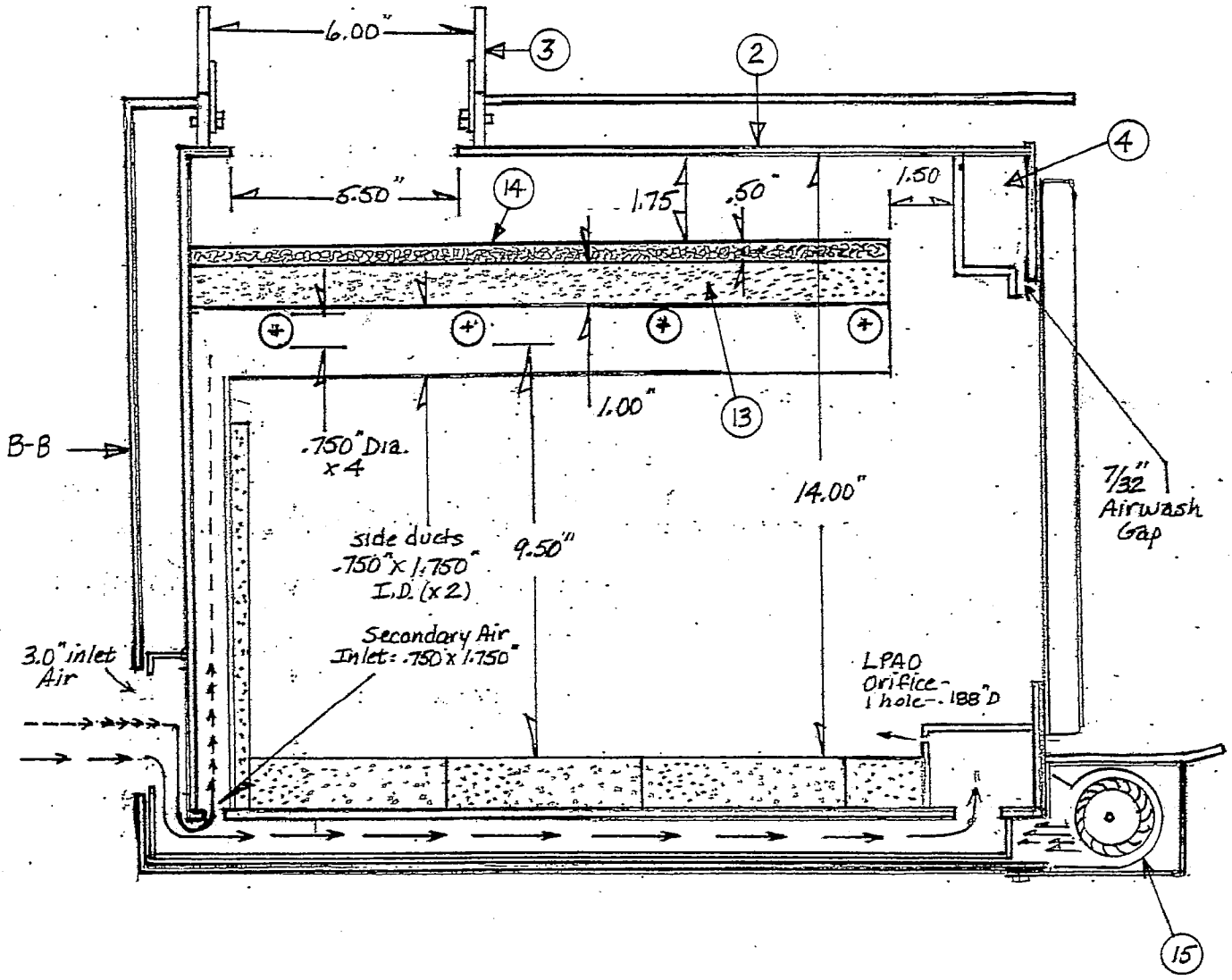
$17.625" \times 0.8333\ 14.687" = 14.625" = 14\frac{5}{8}"$

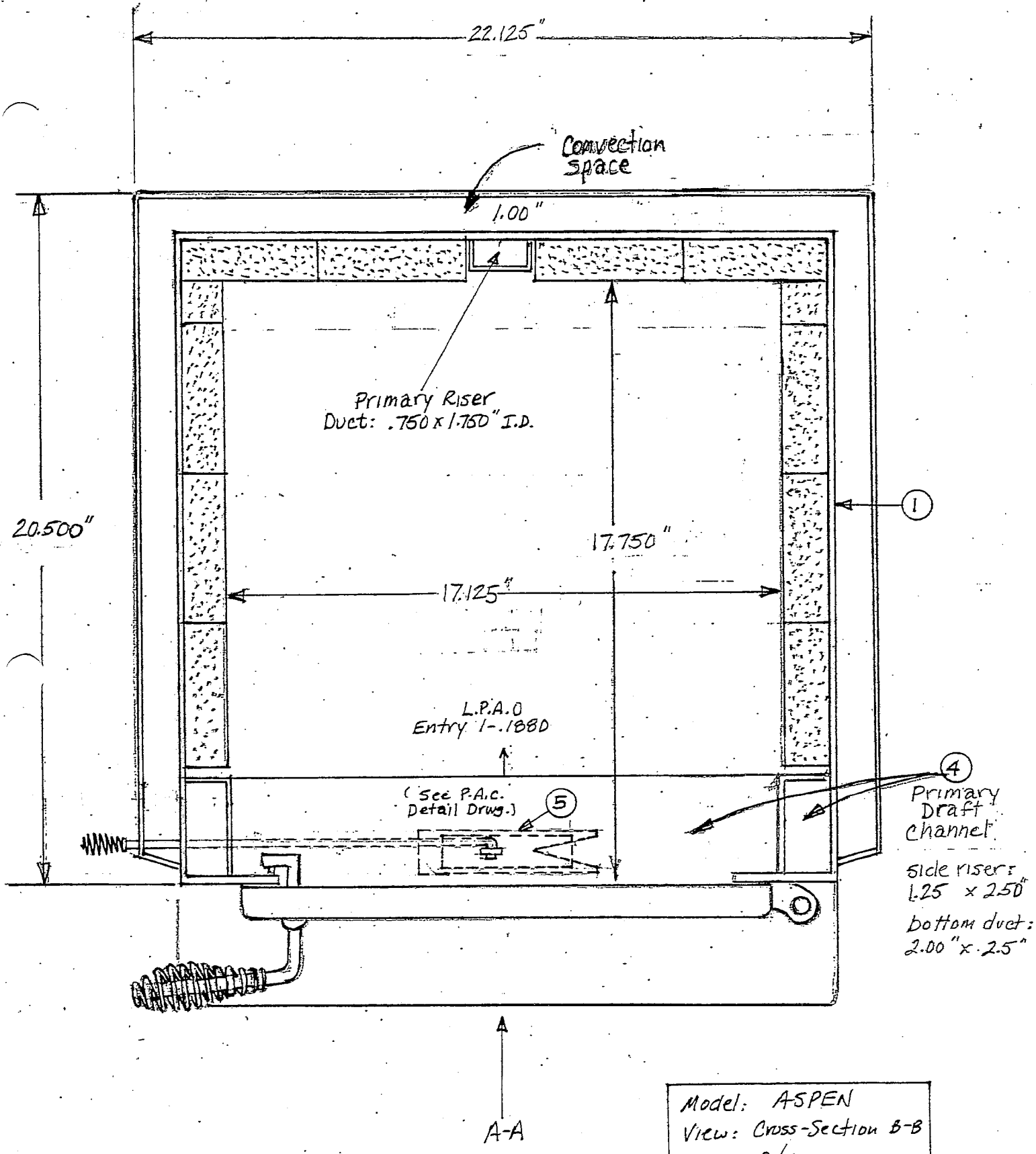
Aspen Part Specifications

Part #	Description	Dimensions (inches)	Quantity	Composition
1	Firebox assembly	20.00x19.375x15.625	1	3/16" Low carbon steel
2	Firebox top	20.00x19.00	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 – 1.5x2.0	2 1 1	10ga. Low carbon steel 10ga. Low carbon steel 10ga. Low carbon steel
5	Primary draft control	1.5x6.0	1	¼" Low carbon steel
6	Secondary draft ducts	Sides 2.0x15.375 Rear- 2.0x19.50 Riser- 2.0x10.313	2 1 1	10ga. Low carbon steel 10ga. Low carbon steel 10ga. Low carbon steel
7	Convection shell	19.75x22x17.75	1	12ga. Low carbon steel
8	Primary feed duct	1.00x4.00x18.00	1	12ga. Low carbon steel
9	Secondary burn tubes	18.375x.75 diameter	4	16ga. Stainless steel
10	Gaskets	Door seal- 49.0x.625 diameter Glass seal- 45.0x.750	1 1	Woven fiberglass 96.5% Fibrous glass 3.5% surface sizing
11	Firebrick	4.5x9.0 1.5x9.0 4.5x8.0 1.5x8.0 4.25x9	11 3 3 1 2	81% Fireclay 19% Silica alumina
12	Baffle	1.0x16.50x17.00	1	#400 compressed vermiculite
13	Baffle wool blanket	.50x17.50x20.00	1	Ceramic wool fiber 6#/sq.ft. density
14	Blower motor	12.00x1.75 diameter	1	EBM Pabst C-Frame motor tangential variable speed controlled
15	Door	13.24x16.0	1	Cast Iron
16	Glass	10.00x12.50	1	5mm Neo-Ceramic

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.

Model: ASPEN
View: Cross-Section A-A
Dat: 8/2010
Dr.: M.F.
Dr.# 1





Model: ASPEN
View: Cross-Section B-B
Date: 8/10
Dr. MF
Dr. # 2

KUMA STOVES, INC.

Model: ASPEN

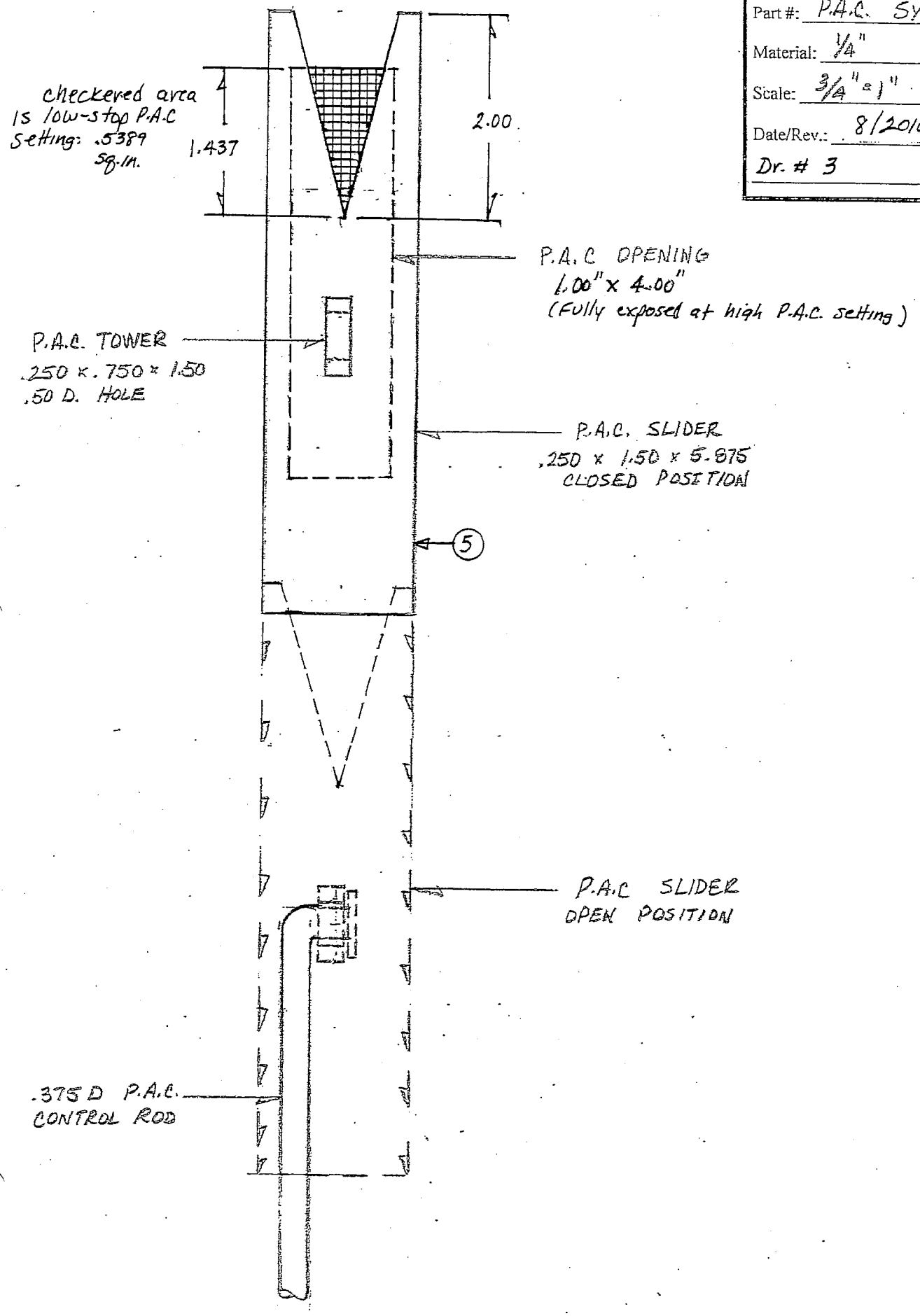
Part #: P.A.C. SYSTEM

Material: 1/4"

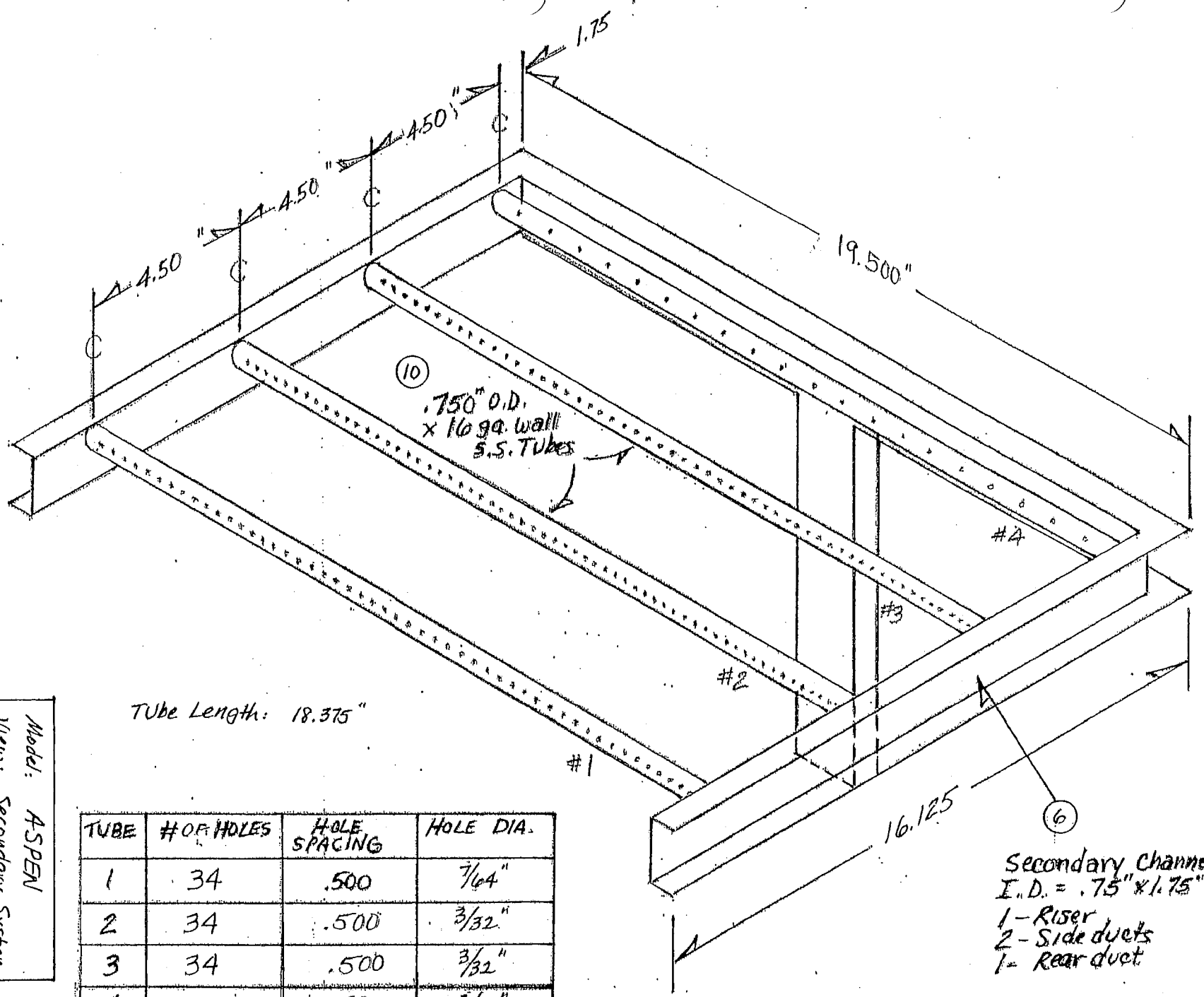
Scale: 3/4" = 1"

Date/Rev.: 8/2010

Dr. # 3



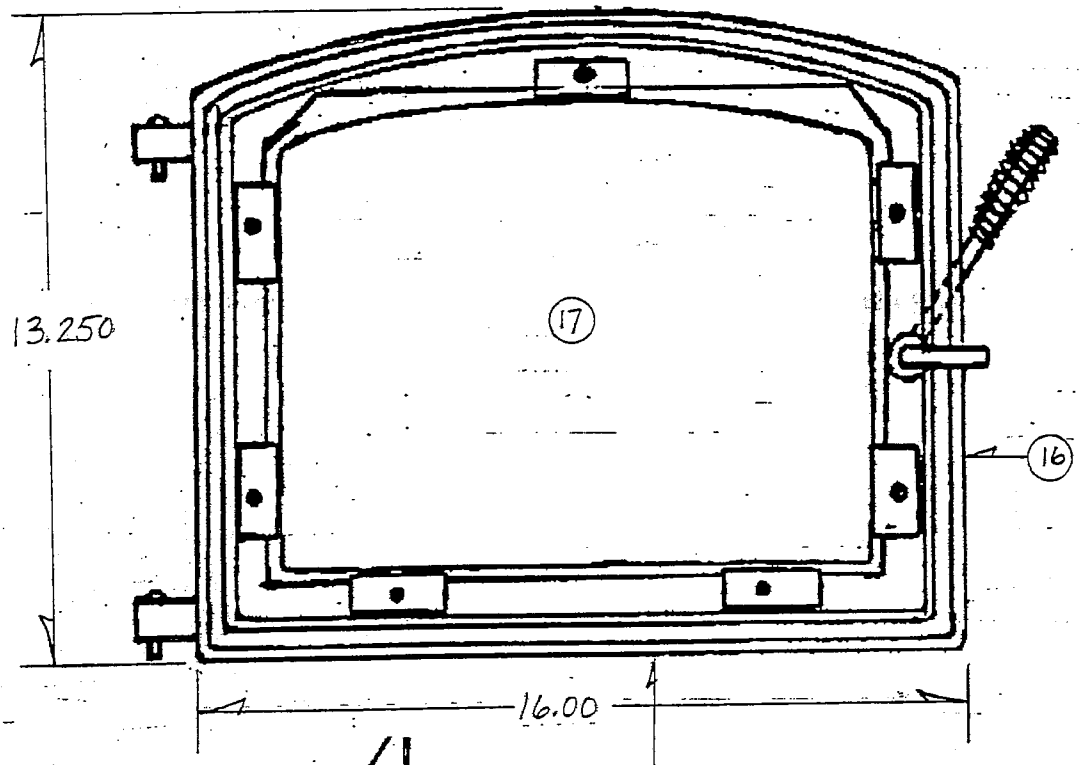
Top of Sleeve

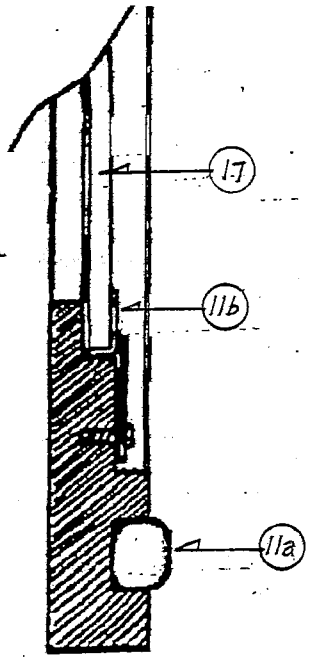


Tube Length: 18.375"

TUBE	# OF HOLES	HOLE SPACING	HOLE DIA.
1	34	.500	7/64"
2	34	.500	3/32"
3	34	.500	3/32"
4	34	.500	3/32"

Model: ASPEN
View: Secondary System
Dat: 8/2010
Dr.: MG
Dr #: 4





Cross-Section
C-C

Model: ASPEN
View: Door
Date: 8/2010
Dr. MG
Dr#: 5

10 July 2010
Mr. Ben Myren
Myren Consulting, Inc.
512 Williams Lake Road
Colville, WA 99114

RE: OPERATING INSTRUCTIONS FOR THE KUMA ASPEN WOODSTOVE

The operating instructions for the Aspen are as follows:

PRIMARY AIR CONTROL (PAC):

To open the primary air inlet orifice and increase the amount of air entering the stove, pull the end of the rod on the left side of the stove away from the stove. To close the primary air inlet orifice and decrease the amount of air entering the stove, push the end of the rod towards the stove.

BURN CATEGORY	PAC
Low: Set control at the stop	At the stop the primary air inlet orifice should be open 1.4375" and the end of the rod should be 2.7785" from the side of the stove. Be certain to check this.
Medium Low:	Set PAC at 1.4375 (stop) – 2.00" open. The end of rod should be between 2.7785 - 3.341" from the side of the stove.
Medium High:	Set PAC at 1.875 – 2.5" open. The end of rod should be between 3.216 and 3.841" from the side of the stove.
High:	Wide Open. Pull the rod all the way out.
Fan Confirmation Test:	Set PAC at 1.4375 (stop) – 2.00" open. The end of rod should be between 2.7785 - 3.341" from the side of the stove.

DOOR:

As soon as the fuel is loaded, close the door. If the fuel load is slow to ignite, crack the door open about 1/16". Monitor and adjust the door so that the impact of the air flow into the stove is maximized, i.e., watch the hot coals in the coal bed and adjust the door so that they become as bright as possible. Close the door as soon as the fuel load ignites. If the flames falter or go out, crack the door open again until the fuel reignites, then close the door.

FAN:

Operate the fan as follows:

Low, Medium Low and Medium High: Turn fan on low at 30 minutes. To set the fan on low, rotate the control knob as far to the right (clockwise) as possible.
High: Turn the fan on high at 5 minutes.
Fan Confirmation Test: Fan is off for the entire test.

LOWER PRIMARY AIR ORIFICE (LPAO):

Clear the coals away from in front of the LPAO on all runs.

If you have any questions, call.

Sincerely,
Jason Freeman, GM

Jason Freeman

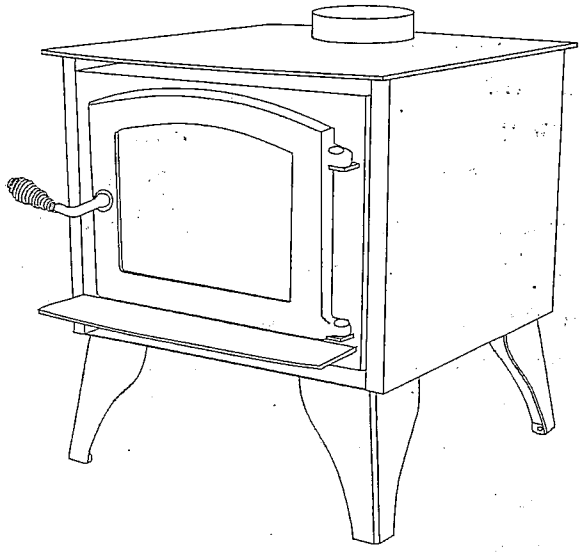
2150 W HAYDEN AVE HAYDEN ID 83835
PHONE (208) 762-8002 FAX (208) 762-5862

DRAFT MANUAL

The owner's manual included in this test report is a draft copy. When a final version of this manual becomes available, a copy will be sent to the US EPA.

KUMA STOVES

50145 N. Old Hwy 95
Rathdrum ID USA



MODEL# K-ASP: **Aspen**

Tested to: ???
Test Report #: ???
Tested and listed by ???

INSTALLATION AND OPERATING INSTRUCTIONS

SAVE THESE INSTRUCTIONS

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 salvation and hope are found through Him. Hope comes from the message of Truth that is found in this New Testament.

Thank you for allowing us the opportunity to warm your home. 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. Consult your local building department for permit and installation requirements.

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 burn garbage or flammable fluids such as gasoline, naptha or engine oil**. Do not use charcoal lighter fluid or similar liquids to start or "freshen up" a fire in this heater. Keep all such fluids well away from the heater while in use. Storing these fluids near a stove could cause a fire.
4. DO NOT CONNECT TO ANY AIR DISTRIBUTION OR DUCT SYSTEM.
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. Over firing can cause damage.
6. WARNING: DO NOT INSTALL IN A SLEEPING ROOM
7. CAUTION: THE STRUCTURAL INTEGRITY OF THE FLOOR, WALLS, AND ROOF/CEILING 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) **Clearances may only be reduces by means approved by the regulatory authority.**
11. Do not operate this stove with the door in an open position, except for cracking open during start-up. Continued operation with the door open can cause overheating of the unit, and expose embers to nearby combustibles.
12. **Do not operate with broken glass. Do not abuse glass such as striking or slamming the door.**
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. Use only approved components for Chimney and Connector. Field fabricated or "makeshift" components are not allowed and can cause a fire.
16. DO NOT USE THIS STOVE WITHOUT INSTALLING THE BAFFLE BOARDS AND CERAMIC INSULATION PACKAGED WITH YOUR STOVE.
17. 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.

18. **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. In Canada, refer to CAN/CSA-B365

Excerpt from NFPA 211

FIGURE 6-7.5 Chimney connector systems and clearances from combustible walls for residential heating appliances.

System		Clearance (in.)/(mm)
A	Minimum 3.5 in. (90 mm) thick brick masonry wall framed into combustible wall with a minimum of 12-in. (305-mm) brick separation from clay liner to combustibles. Fireclay liner (ASTM C 315, *Standard Specification for Clay Fire Linings*, or equivalent), minimum 5/8-in. (16-mm) wall thickness, shall run from outer surface of brick wall to, but not beyond, the inner surface of chimney flue liner and shall be firmly cemented in place.	12/305
B	Solid-insulated, listed factory-built chimney length of the same inside diameter as the chimney connector and having 1 in. (25.4 mm) or more of insulation with a minimum 9-in. (229-mm) air space between the outer wall of the chimney length and combustibles. The inner end of the chimney length shall be flush with the inside of the masonry chimney flue and shall be sealed to the flue and to the brick masonry penetration with non-water-soluble refractory cement. Supports shall be securely fastened to wall surfaces on all sides. Fasteners between supports and the chimney length shall not penetrate the chimney liner.	9/229
C	Sheet steel chimney connector, minimum 24 gauge [0.024 in. (0.61 mm)] in thickness, with a ventilated thimble, minimum 24 gauge [0.024 in. (0.61 mm)] in thickness, having two 1-in. (25.4-mm) air channels, separated from combustibles by a minimum of 6 in. (152 mm) of glass fiber insulation. Opening shall be covered, and thimble supported with a sheet steel support, minimum 24 gauge [0.024 in. (0.61 mm)] in thickness. Supports shall be securely fastened to wall surfaces on all sides and shall be sized to fit and hold chimney section. Fasteners used to secure chimney section shall not penetrate chimney flue liner.	6/152
D	Solid-insulated, listed factory-built chimney length with an inside diameter 2 in. (51 mm) larger than the chimney connector and having 1 in. (25 mm) or more of insulation, serving as a pass-through for a single wall sheet steel chimney connector of minimum 24 gauge [0.024 in. (0.61 mm)] thickness, with a minimum 2-in. (51-mm) air space between the outer wall of chimney section and combustibles. Minimum length of chimney section shall be 12 in. (305 mm). Chimney section concentric with and spaced 1 in. (25.4 mm) away from connector by means of sheet steel support plates on both ends of chimney section. Opening shall be covered, and chimney section supported on both sides with sheet steel supports of minimum 24 gauge [0.024 in. (0.61 mm)] thickness. Supports shall be securely fastened to wall surfaces on all sides and shall be sized to fit and hold chimney section. Fasteners used to secure chimney section shall not penetrate chimney flue liner.	2/51

Additional requirements:

1. Insulation material used as part of wall pass-through system shall be of noncombustible material and shall have a thermal conductivity of 1.0 Btu-in./hr-ft^2-°F (4.88 kg-cal/hr-m^2-°C) or less.
2. All clearances and thicknesses are minimums; larger clearances and thicknesses shall be permitted.
3. Any material used to close up an opening for the connector shall be of noncombustible material.
4. A connector to a masonry chimney, except for System B, shall extend in one continuous piece through the wall pass-through system and the chimney wall to the inner face of the flue liner, but not beyond.

Section 2 – Free Standing Installation Instructions

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.

Stove Components: (each component has installation instructions included. See sec. 8 for a complete list of accessories)

1. Stove body (K-ASP)
2. Pedestal or leg kit (KA-TAMPEDKIT, KA-WLEGSTEEL, etc.)
3. Door Kit (DOOR1CASTC, DOOR1GOLDC, etc.)
4. Outside air kit (KA-OUTSIDEAIR)
5. Optional Blower (KA-BLOWER3)

STEP 1: 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.
5. **WARNING: DO NOT INSTALL IN A SLEEPING ROOM**

STEP 2: INSTALLING THE CHIMNEY.

Use only 6" Class A solid fuel chimney that has been U.L. Safety tested for wood stoves (type 103 HT)

IMPORTANT: These instructions are a very basic guideline for the steps to installing your chimney. For complete, step by step 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: Use only pre-fabricated, listed chimney and connector components. Field fabricated components and/or "makeshift" compromises could result in a chimney or house fire.

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. Note: On metal roofs in snow regions, consideration must be given to snow loads above the chimney that can slide in to chimney and severely damage it. Please consider snow breaks or snow dividers to prevent damage.
2. Once you've determined the stove location based on the applicable clearances and connector type (see section 6), be sure to check attic and roof for any obstructions. Install the chimney system according to the step by step illustrated instructions that came with your chimney.
3. Special care needs to be exercised when passing the chimney through an attic space. An attic insulation shield must be used in all chimney installations to ensure that no insulation can contact the chimney pipe. If there is little or no attic space, or if you have a vaulted ceiling, use a tall square cathedral ceiling support box to pass all the way through to the roof line to provide the shielding.
4. Stability: If necessary, install a roof brace kit on the chimney to stabilize the chimney against wind, etc. Generally, roof bracing is required if the chimney extends more than five feet above the chimney exit point.
5. See illustrations in section 6 for all components required for factory-built chimneys, as well as parts required to connect to an approved masonry chimney.
6. Chimney Height. The Installation Diagram in section 6 shows the minimum chimney height in relation to the roof. With low pitch roofs or little attic space, the chimney can be too short. For proper draft and best performance, a minimum overall height of connector pipe plus chimney combined should be at least 12 feet tall, measured from the stove top to the chimney cap. If necessary, add chimney.

STEP 3: OUTSIDE AIR SUPPLY

Outside Air – An outside air supply is required in all manufactured home installations.

1. **It is the Position of Kuma Stoves that outside air is NOT necessary for the safe and efficient operation of your stove.** However, some state or local building codes may mandate outside air. If your state or local building code requires an outside air supply use part# KA-OUTSIDEAIR. If you are unable to supply a direct connection to the stove, we suggest the following:
    a. Provide a passive air supply to the home. The air vent should be a minimum of 4" in diameter.
    b. The air supply must be provided to the same room that the stove is installed in.
    c. The air supply should utilize a barometric damper so that air is only supplied to the room if the house pressure becomes negative.

    Visit www.woodheat.org for more information on the use of outside air.

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: INSTALLING THE HEARTH

CAUTION: When used with legs, this stove requires a hearth with thermal protection. Your hearth must be ½" non-combustible material with a per inch k-factor of .84 or less. (This is the technical requirement. We strongly suggest using the formula below to convert the requirement to R-value.)

1. Size: The requirements for hearth size for the model Aspen are as follows: It must be non-combustible and extend at least ??" in front of the stove face and ?" minimum beyond the sides and rear of the unit. Thickness and thermal requirements follow below. See next page for diagram.
2. **Aspen with pedestal base:** If your Kuma Aspen stove has a pedestal base, your hearth is only required to provide ember protection. The requirement for ember protection is ANY non-combustible material with a MINIMUM thickness of 3/8".
3. **Aspen with legs:** If your Kuma Aspen stove has legs, your hearth **must** provide thermal protection. Since k-factors cannot be added and are unfamiliar to most inspectors, we suggest that all of your hearth calculations be done in R-value. First, you must convert the k-factor to R-value. To convert k-factor to R-value, divide 1 by actual k, then multiply by the material thickness.

First, turn k per inch into actual k: .84 / .5 = 1.68 actual k value of the ½" material.
Next, convert actual k to R: 1 / 1.68 x .5 = .30 R-value
Your hearth must have an R-value of .30 or greater when installed with legs.

R-value of some common hearth materials

Material	Thickness	R-value
Common Brick	4"	.800
Common Brick	2.25"	.450
Cement Board	.5"	.200
Ceramic Tile	.25"	.020

Based on the material chart above it would take 15 layers of tile for the required R-value. Placing one thickness of tile on top of 3 layers of cement board would meet the requirement and be less than 1.5" thick.

R-value of less common hearth materials

Material	Thickness	R-value
Ceramic Board	.5"	1.10
Flagstone	1"	.079
Marble	1"	.090
Granite	1"	.083

Based on the material chart above it would take almost 4" of granite for the required R-value. Placing one thickness of granite on top of 1 layer of ceramic board would be well over the requirement and be less than 2" thick.

Key things to remember when determining your hearth design.
1. Thermal protection is only required if your Ashwood has legs.
2. Work in R-value since R is more common and R-values can be added.
3. Never install on an existing hearth unless you are sure the R-value is .30 or greater.

Aspen as an insert: If your Aspen is being installed as a fireplace insert in either an approved masonry or factory-built fireplace, the following hearth protection is required:

a. A 1" minimum non-combustible material under the insert that extends at least 17" in front of the insert face as well as 8" to either side of the insert (this 17" is measured from the face of the insert and not the ash lip). **This 1" material must have an R-value of 1.2 or greater.** Please refer to the tables above for the R-values of common materials.

b. If your Ashwood extends out from the fireplace face but does not rest on the hearth in front **and** has at least 2" of airspace between the hearth and insert bottom, then only ember protection as explained in pp. 2 above is required.

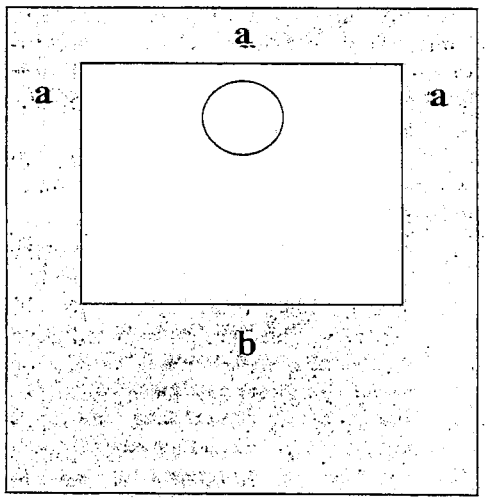
MINIMUM Floor Protection size Requirements.

For Free Standing Stove.

	USA	Canada
a	6"	8"
b	16"	18"

For Fireplace insert

	USA	Canada
a	8"	8"
b	17"	18"



STEP 5: 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 approved single (min. 24 MSG Black or 26 MSG Blued)- or double-wall pipe, (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. Secure the pipe to stove flue collar with 3 screws.
4. If installing in a mobile home, 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. (This applies to mobile homes only). 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*" as well as *"Before Operating"* checklist before lighting your first fire.

Section 3.1 –Masonry Fireplace installation

The Kuma model Aspen is certified for installation into a fireplace with a masonry chimney that is manufactured in accordance with NFPA 211. A Safety listed 6" fireplace liner must be installed and directly connected to the appliance. The single-wall liner must extend 6.5' above the stovetop. For Canada installations, this 6.5' must be insulated with an appropriate insulation and must conform to the Class 3 requirements of CAN/ULC-S635, Standard for lining Systems for existing masonry or Factory Built Chimneys and vents, or CAN/ULC-S640, Standard for lining systems for New masonry Chimneys. For optimum performance and ease of cleaning, it is recommended that an approved chimney liner be installed all the way to the chimney top.

Check to make sure that the fireplace flue is in good usable condition. This is best determined by a licensed professional (certified chimney sweep or NFI certified technician).

Prior to installation:

1. Check for cracks, loose or damaged mortar joints, blockages, or extraordinary deterioration.
2. The chimney must have at least a 2" clearance to combustible inside and outside the house.
3. The chimney must have a 5/8" thick fireclay liner. If you have an older, unlined masonry chimney, then you must install an approved chimney liner system including a thermal wrap that will bring your existing chimney up to the requirements of U.L. 1777. Contact your dealer or a licensed chimney professional if you have any questions.
4. Check for any gap existing between the masonry fireplace construction and the fascia masonry. If there is a gap, seal with a high temperature masonry mortar.
5. If outside air is required by local building code then it should be connected to the back of the fireplace prior to installation.
    a. The outside air vent can not exceed in length, the vertical height of the exhaust flue.
    b. The outside air vent must be installed where it will remain free of snow, ice, or debris.
    c. The outside air vent must not terminate close to exhaust vents.

Guidelines for installation:

1. Secure the damper in the open position.
2. Install a 6" diameter listed stainless steel flue liner according to the manufacturers instructions. The flue collar on the stove must be attached to the end of the liner for quick installation and removal:
    a. Loosen the flue collar bolts and remove the collar from the stove.
    b. Install the flue collar to the liner using 3 stainless steel sheet metal screws.
    c. Slide the stove into place. (leveling bolts are supplied with the surround kit)
    d. From inside the stove, reach through the flue collar, grab the flue collar and pull down to the stove, lining up the holes in the collar with the bolt holes in the stove.
    e. Tighten the bolts securing the flue collar to the stove
    f. Install the baffle board and ceramic blanket into the stove using the directions supplied with the baffle set.
3. Install the fireplace surround (KA-ASPSURROUND) using the instructions supplied with the kit. SEE SECTION 6 FOR INSERT INSTALLATION CLEARANCES AND DIAGRAMS.

    NOTE: *Consideration must be given to ensure an adequate supply of combustion air for your insert.*

    *Make sure the air cover on the back of the stove is removed

    *If your fireplace is equipped with an outside air source, then simply make sure that vent is open. As with any vent open to the outside, make sure there is a rodent screen installed to prevent any unwanted intrusion.

    *If an outside air direct connection is desired, the parts included in the Kuma outside air kit (part # KA-OUTSIDEAIR) will make this connection possible.

    *If room air is used, the small gaps that naturally occur between the surround kit and the face of the fireplace should be adequate for combustion air. Do not insulate behind the surround panel. If combustion appears lazy, try installing some small spacers at the surround panel edge so that it will stand off from the fireplace face ¼". It is up to you to make sure there is an adequate free air supply for optimum performance from your insert.

Section 3.2 – Factory Built Fireplace installation

The fireplace must not be altered, except for the exceptions listed below. A permanent metal warning label must be attached to the back of the fireplace, stating that the fireplace may have been altered to accommodate the insert, and must be returned to original condition for use as a conventional fireplace. The following modifications are permissible: removal of damper, removal of smoke shelf or baffle, removal of ember catches, removal of fire grates, removal of viewing screen/curtain, and removal of doors.

The factory built chimney must be listed per UL 127 (US), and meet type HT requirements of UL 103 (US). Factory built fireplace chimneys tested to UL 127-1998, may be at the fireplace manufacturer's option, tested to the same criteria as UL 103 HT requirements. If the chimney is not listed as meeting HT requirements, or if the factory built fireplace was tested prior to 1998, a full height listed chimney liner must be installed from the appliance flue collar to the chimney top. The liner must meet type HT requirements (2100 F) per UL 1777 (US). The liner must be securely attached to the insert flue collar and the chimney top. To prevent room air passage to the chimney cavity of the fireplace, seal the damper area with high temperature sealant.

The Kuma model Aspen is certified to ULC-S628 for installation into a properly installed factory built fireplace in the U.S. and Canada. A Safety listed 6" fireplace liner must be installed and directly connected to the appliance. The liner must be at least 6.5' above the insert, and if it is a Canadian installation, the liner must be insulated and must conform to the Class 3 requirements of CAN/ULC-S635, Standard for lining Systems for existing masonry or Factory Built Chimneys and vents, or CAN/ULC-S640, Standard for lining systems for New masonry Chimneys. For optimum performance and ease of cleaning, it is recommended that an approved liner be installed all the way to the chimney top.

Prior to installation:

1. The following items may be removed in order to facilitate the liner installation: Smoke Shelf/Baffle, Wood Grate, Viewing Screen, Damper, and ember catches.
2. The Fireplace itself must not be altered (with the exception of damper removal). Any non-functioning trims that are removed must be kept so that the fireplace can be restored to full working order if the insert is ever removed.
3. The local building department has the final authority to approve, with a permit, the installation of this appliance into a factory built fireplace. DO NOT INSTALL WITHOUT A PERMIT.
4. Check for any gap existing between the masonry fireplace construction and the fascia masonry. If there is a gap, seal with a high temperature masonry mortar.
5. The installation of the fireplace liner must in no way limit the airflow of the factory built chimney.
6. The original factory built chimney cap must be reinstalled after the installation of the liner.

Notes on manufactured homes and fireplaces:

1. If you are installing the Aspen into a manufactured home, the fireplace must be manufactured home approved with outside air capabilities.
2. The outside combustion air that is fueling the fireplace must be supplied to the air intake on the back of the Ashwood. Where the outside combustion air enters the fireplace will most likely vary depending on the particular fireplace. You will just need to make sure that the air entering the fireplace will not be blocked by setting the unit into place.
3. All of the above guidelines in this section must be followed.

Guidelines for installation:

Use only pre-fabricated, listed components. Use of field fabricated components and/or using "makeshift" compromises could result in a house fire.

1. Secure the damper in the open position.

2. Install a 6" diameter listed stainless steel flue liner according to the manufacturers instructions. The flue collar on the stove must be attached to the end of the liner for quick installation and removal:
    a. Remove the bolts in the flue collar and remove the collar.
    b. Install the flue collar to the liner using 3 stainless steel sheet metal screws.
    c. Slide the stove into place. (leveling bolts are supplied with the surround kit)
    d. From inside the stove, reach through the flue collar, grab the flue collar and pull down to the stove, lining up the holes in the collar with the bolt holes in the stove. Re-attach the flue collar with the bolts that came out.
    e. Install the baffle board and ceramic blanket into the stove using the directions supplied with the baffle set.
3. Install the fireplace surround (KA-ASPSURROUND) using the instructions supplied with the kit.

SEE SECTION 6 FOR INSERT INSTALLATION CLEARANCES AND DIAGRAMS.

NOTE: *Consideration must be given to ensure an adequate supply of combustion air for your insert.*

*Make sure the cover plate at the back of the stove is removed

*If your fireplace is equipped with an outside air source, then simply make sure that vent is open. As with any vent open to the outside, make sure there is a rodent screen installed to prevent any unwanted intrusion.

*If an outside air direct connection is desired, the parts included in the Kuma outside air kit (part # KA-OUTSIDEAIR) will make this connection possible.

*If room air is used, the small gaps that naturally occur between the surround kit and the face of the fireplace should be adequate for combustion air. Do not insulate behind the surround panel. If combustion appears lazy, try installing some small spacers at the surround panel edge so that it will stand off from the fireplace face ¼". It is up to you to make sure there is an adequate free air supply for optimum performance from your insert.

Section 4 – Wood burning operation instructions

IMPORTANT:
Your new KUMA wood stove is shipped with the baffle packaged in a bag with the stove to eliminate damage in shipping. Please follow the detailed installation instructions included with the baffle materials. It is important that the baffle is correctly installed, if you have any questions, please contact the dealer where you purchased your stove, or call us directly at 888-714-5294

CAUTION: HOT WHILE IN OPERATION. KEEP CHILDREN, CLOTHING AND FURNITURE AWAY. CONTACT MAY CAUSE SKIN BURNS.

IN THE EVENT OF A CHIMNEY FIRE, CLOSE AIR DAMPER COMPLETELY

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 Aspen 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 will be pulled all the way out to the left.
NEVER USE FLAMMABLE LIQUIDS TO START OR FRESHEN UP A FIRE. Using flammable liquids can be explosive and cause personal injury or even death.
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. **Do not build the fire too close to the glass. Leave at least one inch between the glass and the fuel.** When starting a fire, avoid using unsplit pieces of wood unless they are small such as twigs and branches, as split wood lights easier. Once the wood is stacked in the firebox, light the fire starter and leave the door slightly cracked open for up to 10 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. Note that burning enough wood to establish a good, thick coal bed is essential to a successful long burn. 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. **Do not alter this air control mechanism.**

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 listed clearance from the stove. Keep wood away from the loading door or ashpan if equipped.
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. Your Aspen "washes" the primary air down over the glass, helping to keep the glass cleaner. If your stove glass has a smoky build-up, adding dry, split pieces of wood and burning a full-open hot fire will begin to burn the glass clean. Doing this in the morning will not only clean the glass, but re-builds the heat level for an efficient burn, warming the chimney system as well as the secondary burn system.
4. Break in period. In addition to the paint curing, several other things may occur as the stove breaks in.
    a. Popping and creaking: As the metal heats up and cools down, it moves. This movement can cause a normal popping or creaking sound that will likely decrease over the first several fires.
    b. Performance: It is normal for the first few fires to seem a bit lazy. As moisture evaporates from the brick, the fire will become more active. A layer of ash in the bottom of the stove will also help to keep your coal bed hot and active. A good thick coal bed and full load of wood are key to optimum performance.
    c. Smoking: As the stove heats up for the first time, a small amount of haze or smoke will bake off of the stove, mostly due to the paint curing process. Oils on the metal will also casue a slight haze, but will subside within 2-3 hours.

***A word on fuel-* Only burn cordwood or lumber that is properly seasoned. Never burn railroad ties, power poles, or other wood that is treated or creosote-soaked. Do not burn garbage, plastic, rubber, etc.

**Densified fuel-* It is ok to burn densified fuel (i.e. fuel that has been compressed from wood waste such as sawdust into a densified form such as a log or brick). These are sometimes called energy logs, energy bricks, or bio-bricks. These fuels must be from natural wood products or plant based only. Do not burn logs that have glues, waxes, or other binders in them. Care needs to be given when burning these densified fuels in order to prevent overheating the stove. If any part of your stove glows, you are overfiring. Because of their density, these fuels contain high BTU content. Do not burn too many at once at a high burn rate. Common sense must prevail.

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. When routing the blower power cord, take care to keep it away from hot surfaces or surfaces that could case abrasion.

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. CAUTION: When replacing parts, do not substitute any part or material other than factory parts or a factory authorized substitution. If you have questions about substitute parts, contact your dealer.

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 2-3 months or as needed.
Replace ceramic insulation	Every year or as needed

Ash disposal – Every 1-2 weeks

1. Empty the ashes when the fire is out. Never try to empty the ashes when the stove has an active or full fire.
2. Using a small shovel, scoop the ashes out of the firebox into a metal container. Remove the ash container from the house. **DO NOT PLACE THE ASHES NEAR THE HOUSE OR IN THE GARAGE.**

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.
3. Every few months inspect the chimney for build-up of creosote or soot. Clean as necessary. Generally, a ¼" build-up or more should be cleaned.

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 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. Glass replacement must be 5mm thickness, approved clear ceramic glass such as Neoceram, Robax, Pyro-ceram, or other glass approved for high temperature applications. Do not use tempered glass or Borosilicate. See section 8 for replacement glass part number and size. 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.

Clean and inspect stove – Every 2-3 months or as needed

1. Your stove should be fully cleaned and inspected once a year. Every 2-3 months, visually check the stove interior, especially for ash build up on top of the ceramic insulation. 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 burn tubes. Discoloration of the stainless steel is normal.
2. FOR INSERT.
    a. Remove the surround panel by unscrewing the two adjustable retaining screws on the front of the top panel.
    b. Remove the front two burn tubes.
    c. Remove the ceramic insulation and the two baffle boards.
    d. Use a 7/16 wrench or socket wrench to remove the two flue collar retaining bolts and push the liner up out of the stove, or if there is room, reach in above the stove and pull the liner out.
    e. Pull the insert forward to inspect or clean. NOTE: it is not necessary to remove the insert if a full height liner has been installed to the chimney top. Only the baffle tubes, insulation and boards should be removed for cleaning. Partial liners can build up soot in the fireplace cavity and will require insert removal for proper cleaning.

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.

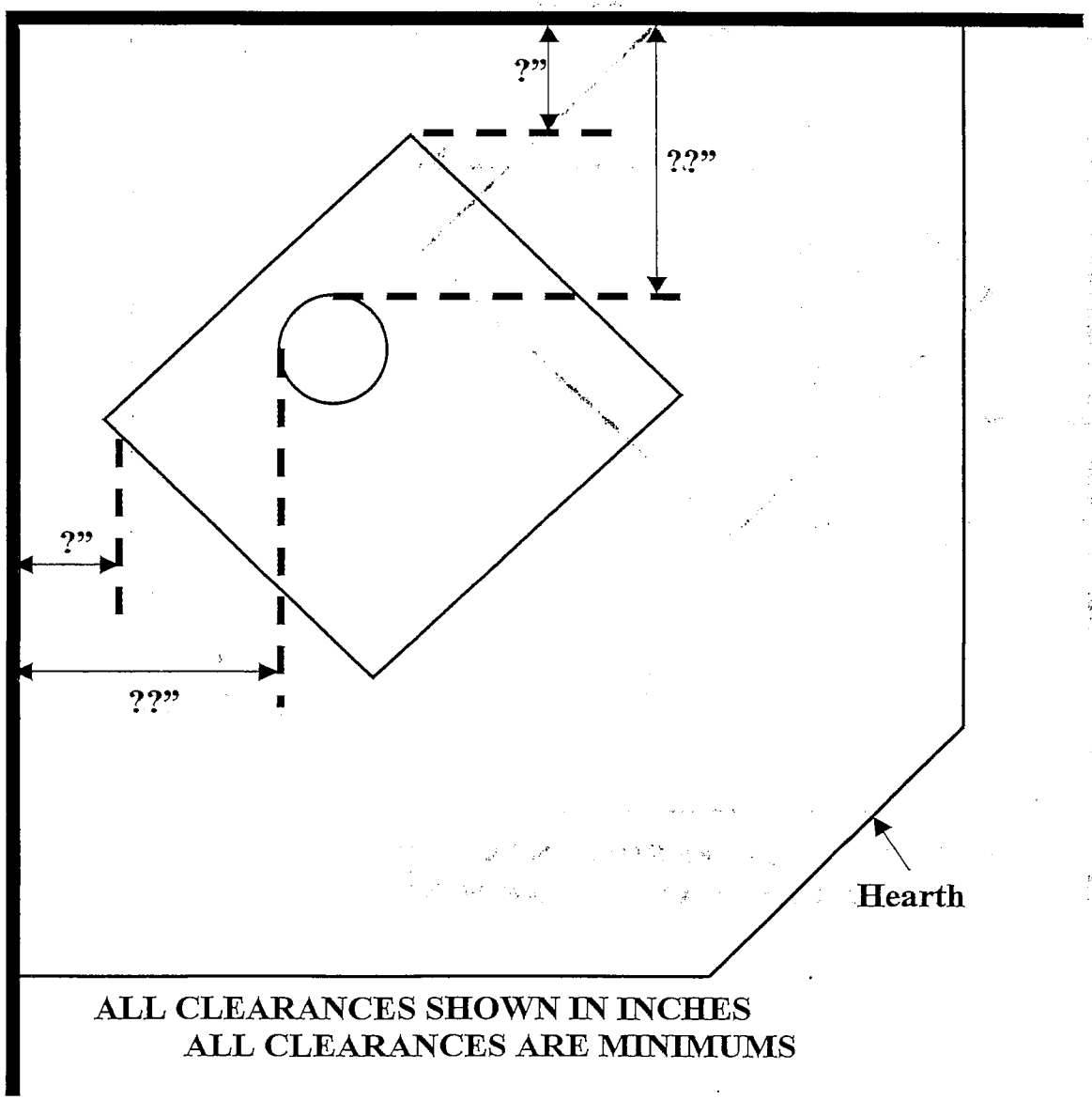


Figure #2 Single Wall Pipe
Use this diagram for the following installation:

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

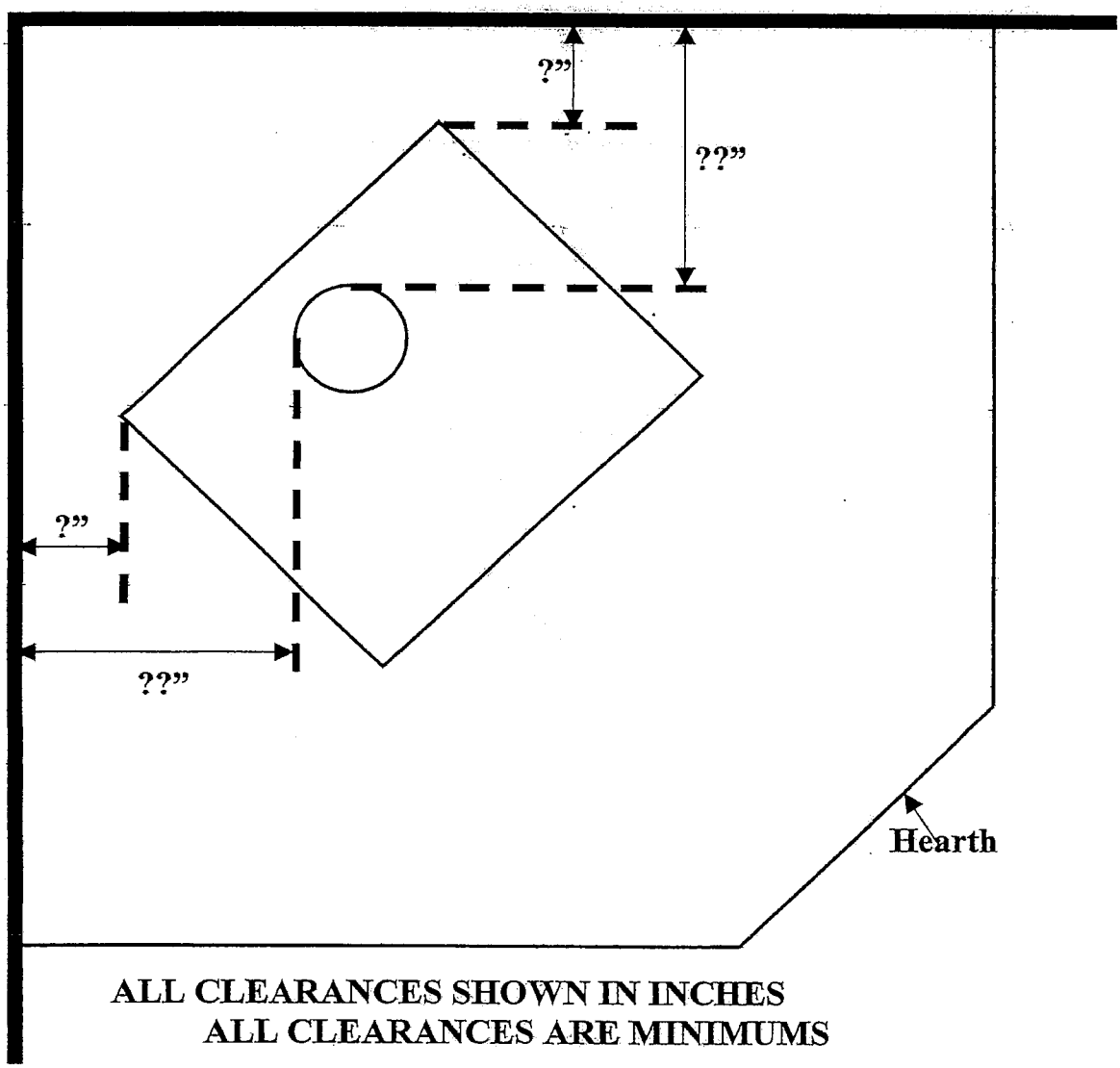
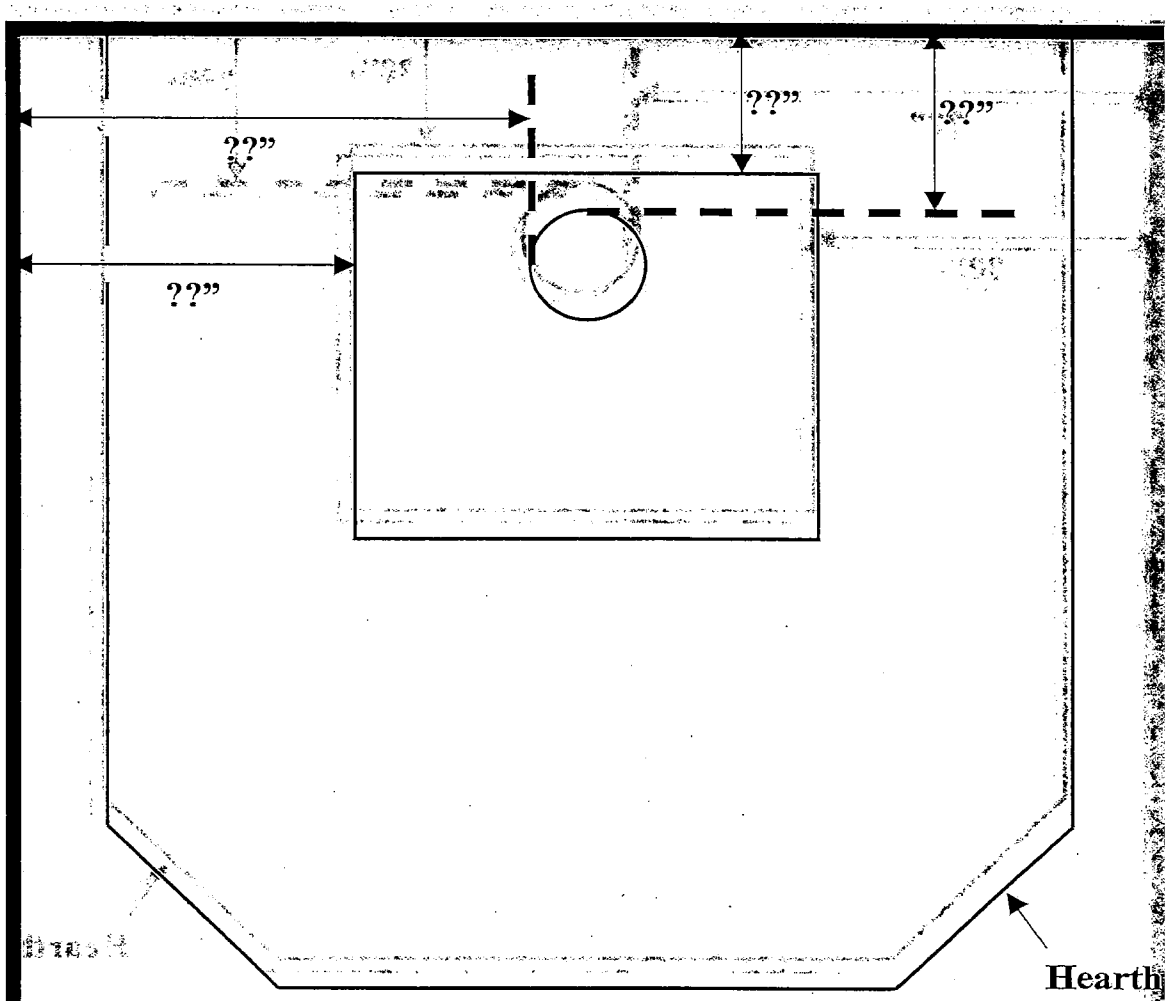


Figure #3 Double Wall Pipe

Use this diagram for the following installations:

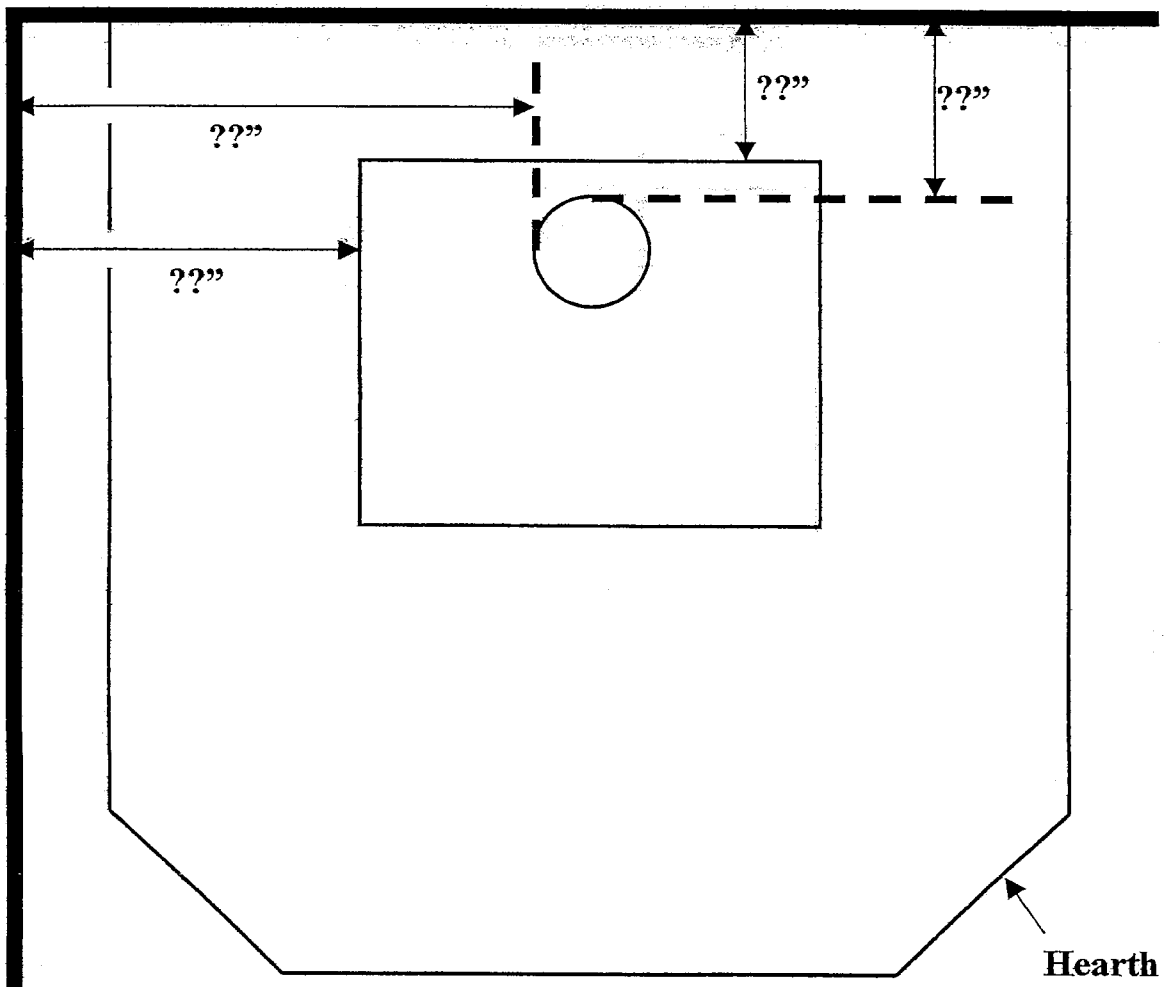
1. Mobile home installation with the stove on a straight wall using double wall pipe.
2. Residential installation with the stove on a sraight wall using double wall pipe. For single wall pipe, refer to figure 4.



ALL CLEARANCES SHOWN IN INCHES
ALL CLEARANCES ARE MINUMUMS

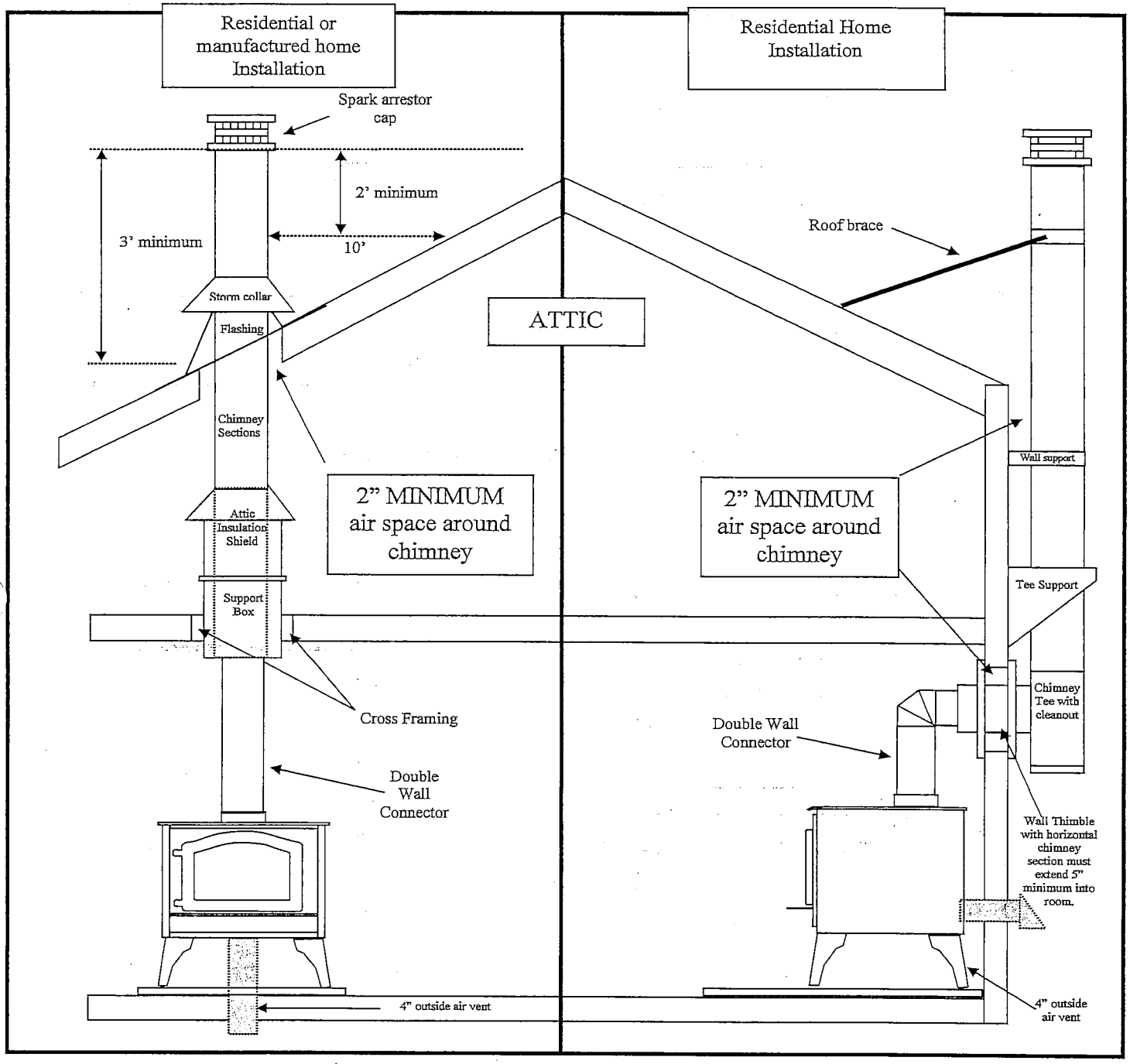
Figure #4 Single Wall Pipe
Use this diagram for the following installations:

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.



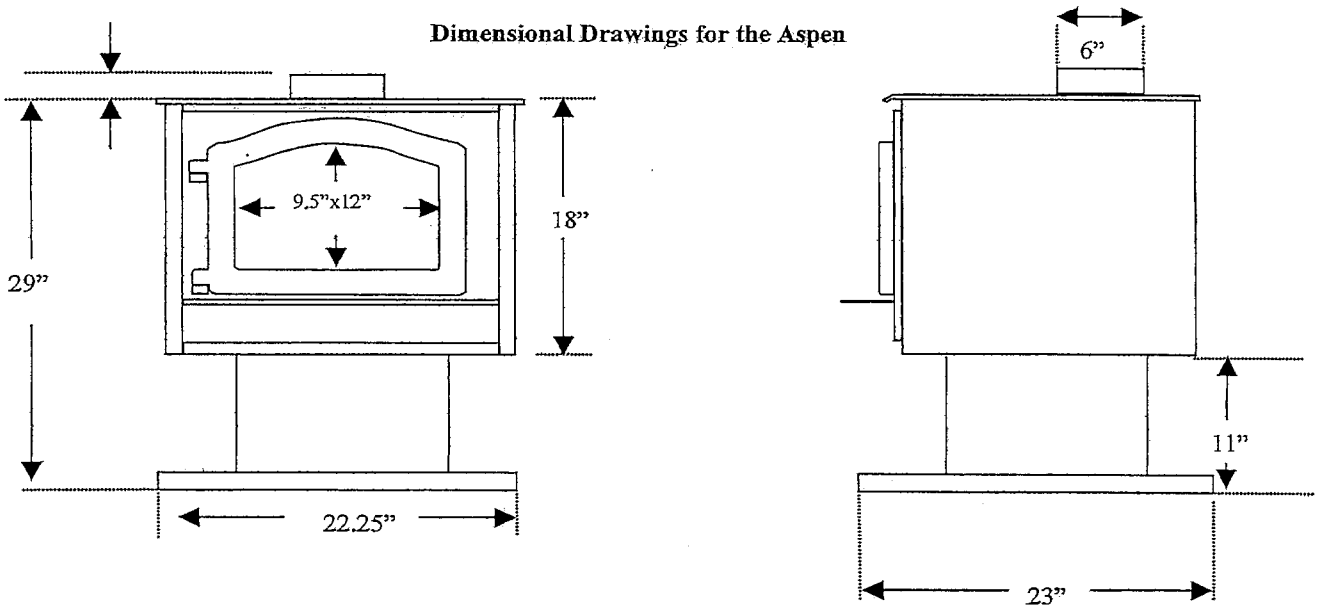
ALL CLEARANCES SHOWN IN INCHES
ALL CLEARANCES ARE MINIMUMS
HEARTH CLEARANCES SHOWN IN

Aspen Installation diagram for manufactured chimneys
NEVER INSTALL A WOOD STOVE IN A SLEEPING ROOM

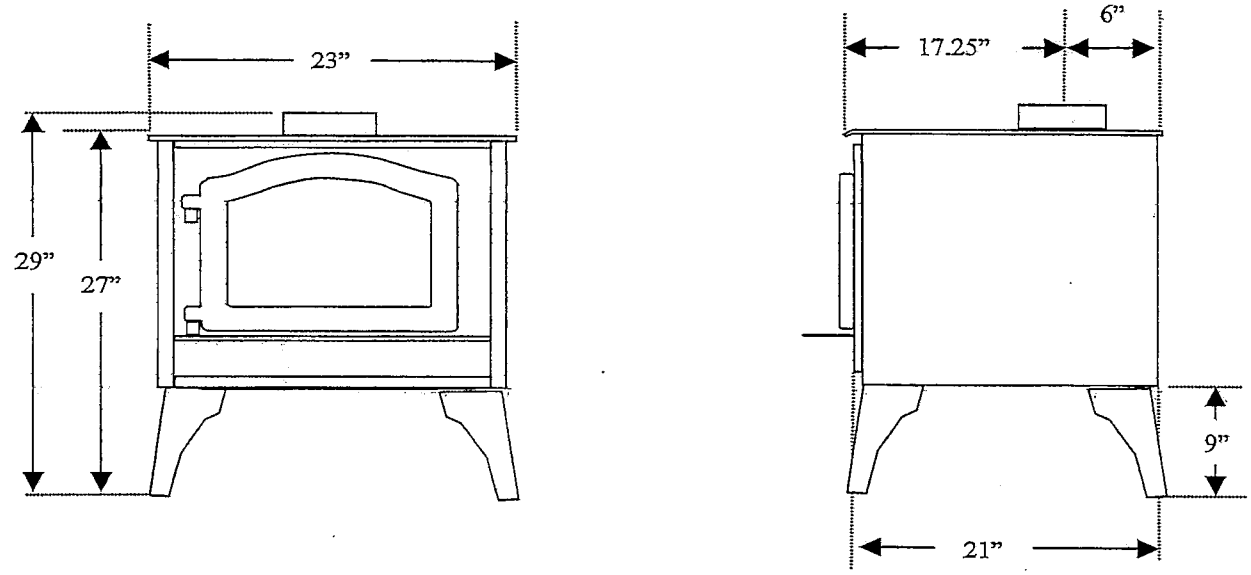


These diagrams are for manufactured chimneys. For Brick Chimneys a safety listed thimble must be used when a connection is made through a combustible wall to a lined masonry chimney. This stove must be connected to a lined masonry chimney or a listed factory built chimney designed for use with solid 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 Aspen



Aspen Pedestal (K-ASP + KA-TAMPEDKIT)

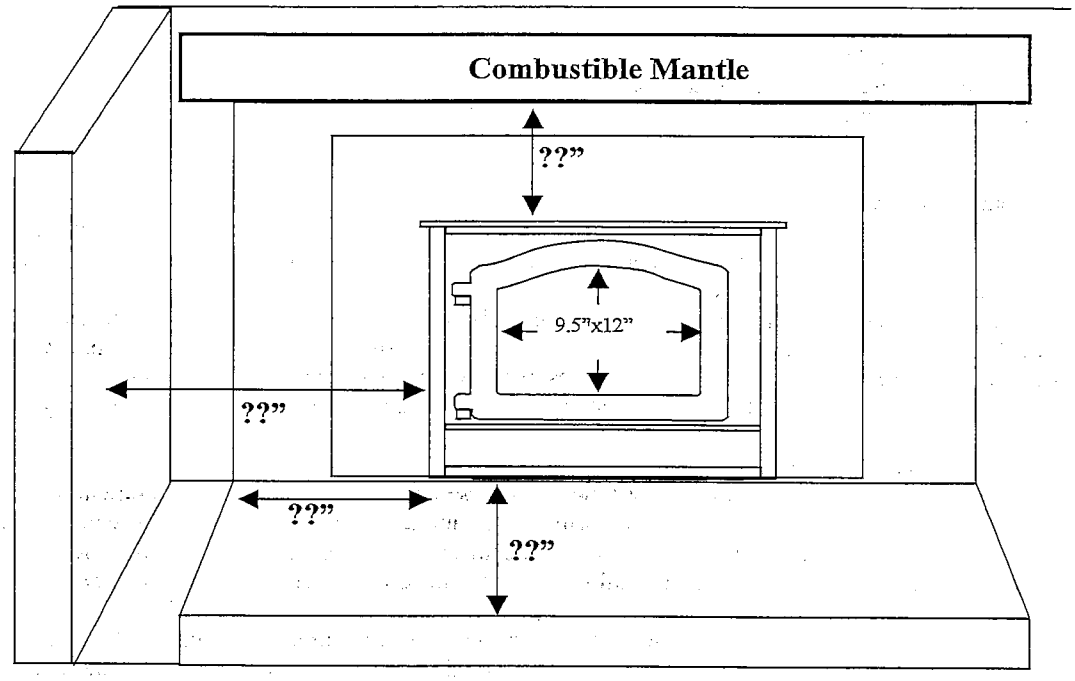


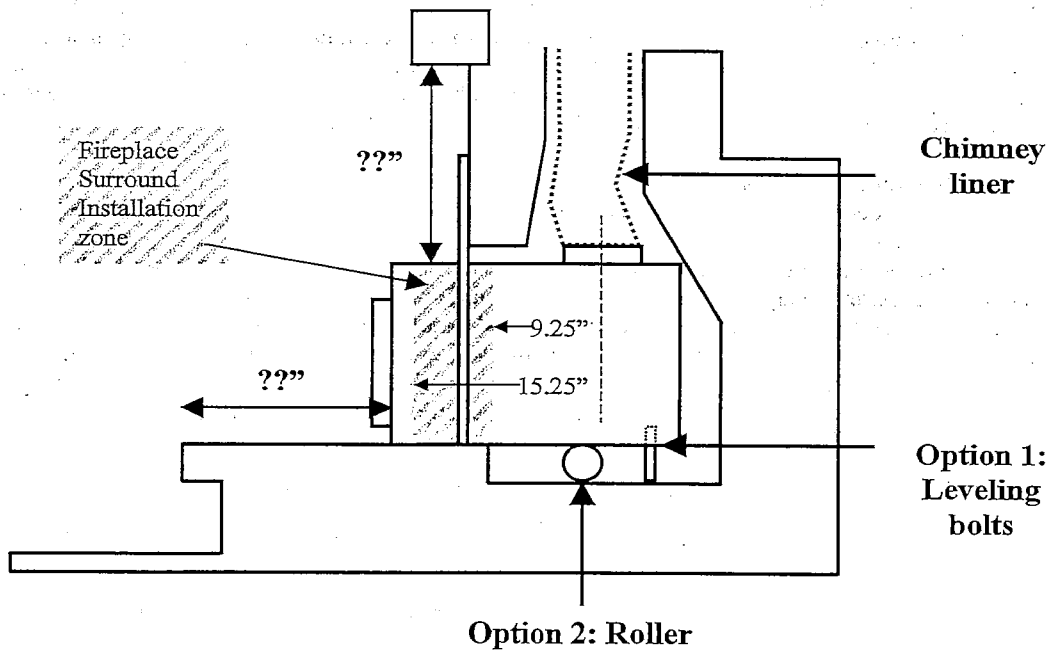
Ashwood Leg (K-ASP + KA-WLEGSTEEL)

Figure #5 Insert

Use this diagram for the following installations:

1. Installation into a masonry fireplace
2. Installation into factory built 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.

1. The chimney is still cool, allow more time to warm up. Burn longer with door slightly cracked.
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.

Stove back-puffs or smokes into the room at start up.

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. Screened caps are required by H.U. D. code on mobile homes only. Non-mobile residential installations may remove the screen part of the cap. Check local codes.

Stove smokes out the door when it is open.

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.
3. Chimney is too short or other conditions exist such as a hillside home location, high winds, trees, etc.

Stove won't shut down.

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.

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.

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-BLOWER3- 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-TAMPEDKIT(BOX 1)- Pedestal kit
8. KA-SUNBURST1BLK- Decorative window sunburst, painted black.
9. KA-DOOR1CASTC- Complete black door. Includes: Glass, glass holder, gaskets, door handle and door pins.
10. KA-DOOR1GOLDC- Complete gold door. Includes: Glass, glass holder, gaskets, door handle and door pins.
11. KA-DOOR1PEWTERC- Complete pewter door. Includes: Glass, glass holder, gaskets, door handle and door pins.
12. KA-ASPSURROUND- Fireplace surround kit.

Parts

1. KR-BRICK- Individual replacement firebrick.
2. KR-DOORGASKET- Replacement door gasket, includes glue.
3. KR-GLASS1- Replacement glass, includes gasket.
4. KR-GLASSGASKET- Replacement glass gasket
5. KR-ASPBURNTUBE1- Front baffle burn tube.
6. KR-ASPBURNTUBE2- Middle-front baffle burn tube.
7. KR-ASPBURNTUBE3- Middle-rear baffle burn tube.
8. KR-ASPBURNTUBE4- Rear baffle burn tube.
9. KR-ASPINSULATION- Ceramic baffle insulation.
10. KR-ASPBAFFLE- Ceramic baffle board (2 pc.)

Section 9 – Warranty

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).

NOT WARRANTED:

Including but not limited to: Firebrick, ceramic insulation, door gasket, glass, 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.

WOODSTOVE DATA SHEET # 30 stove storage4/99

STOVE STORAGE

The Kuma Aspen Noncatalytic Wood Heater 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
JASON 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: manufacturer's truck.

WST5-Form11

W A R N I N G

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 Aspen

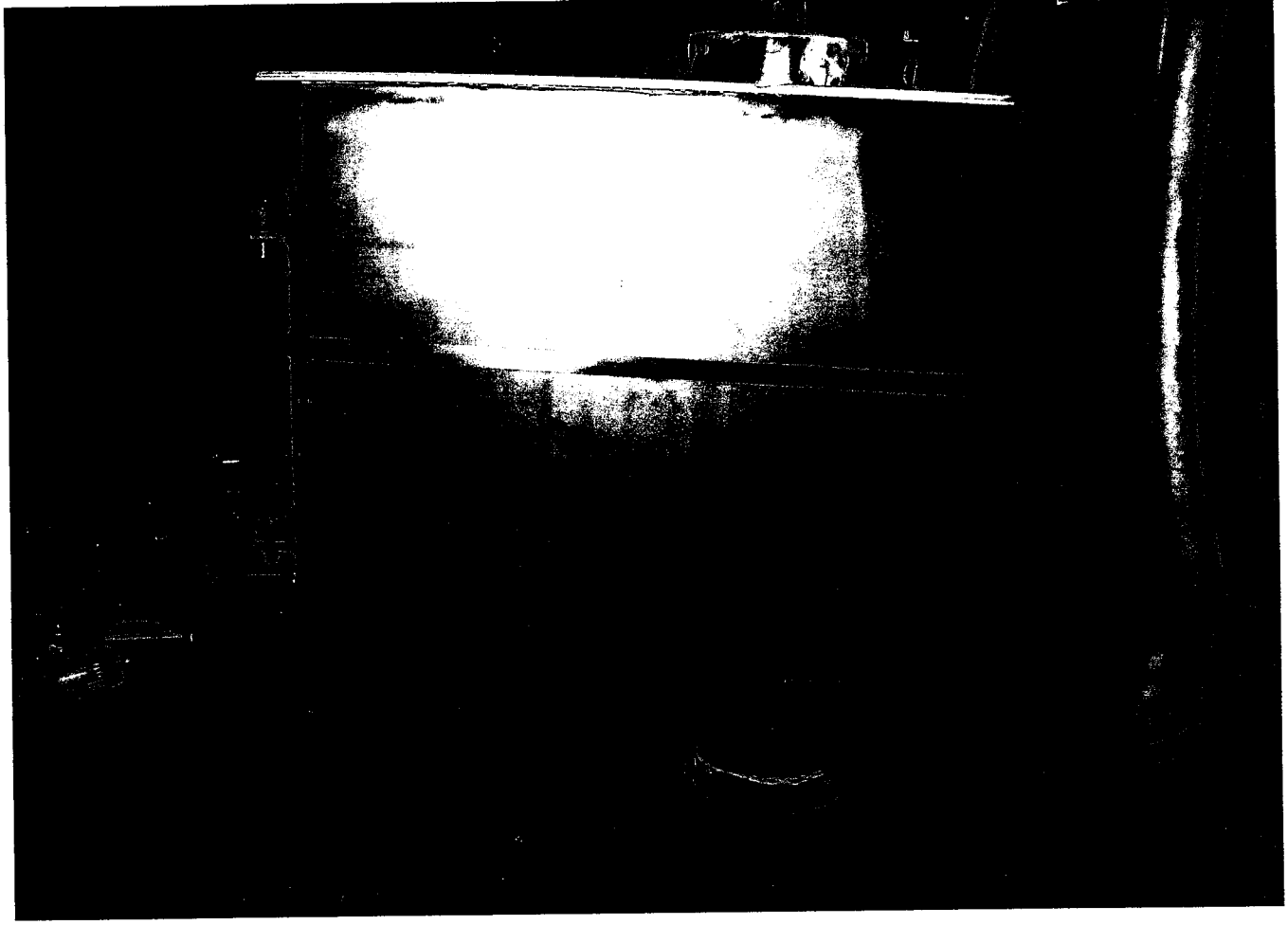
WST5-Form11

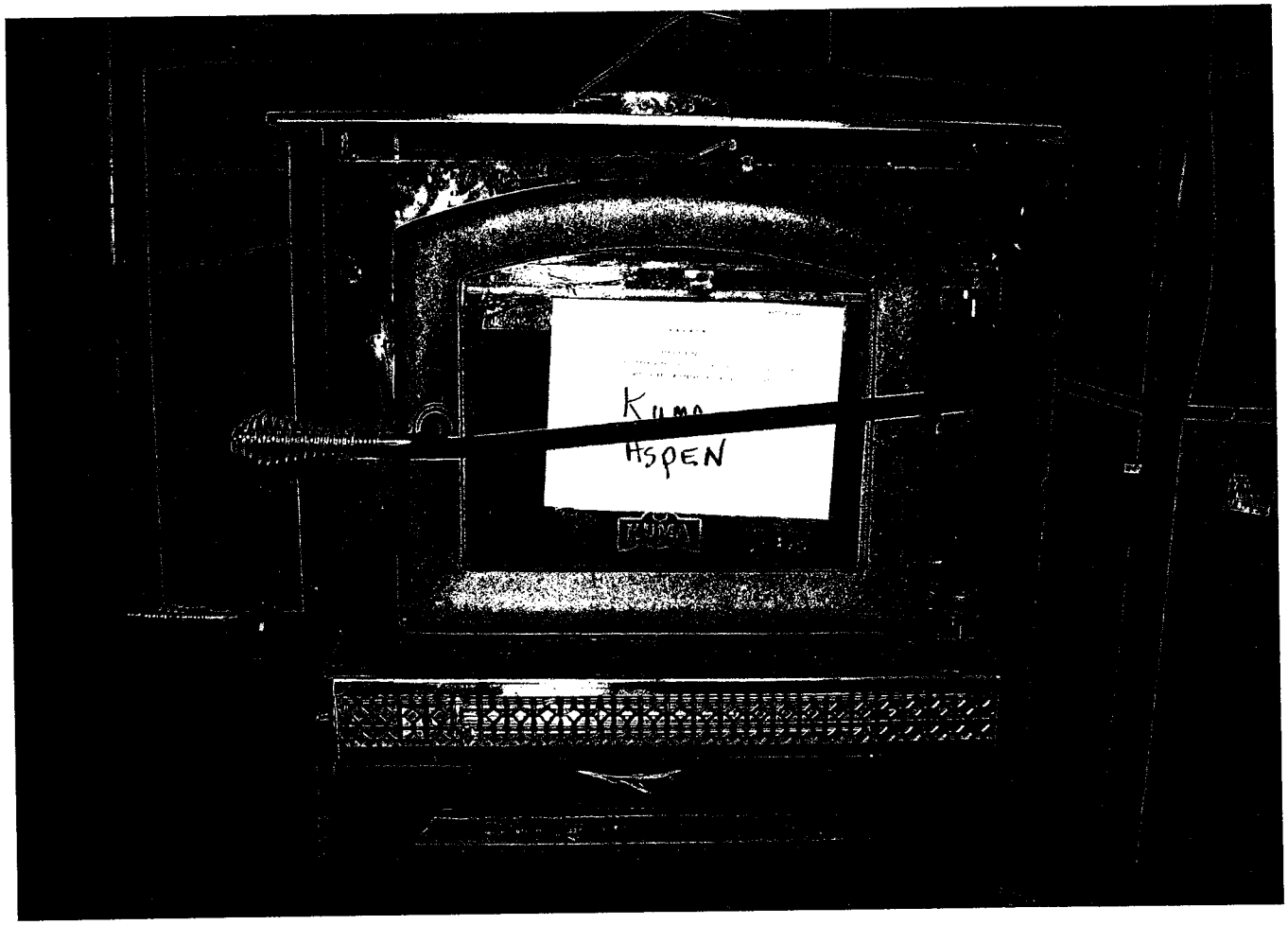
W A R N I N G

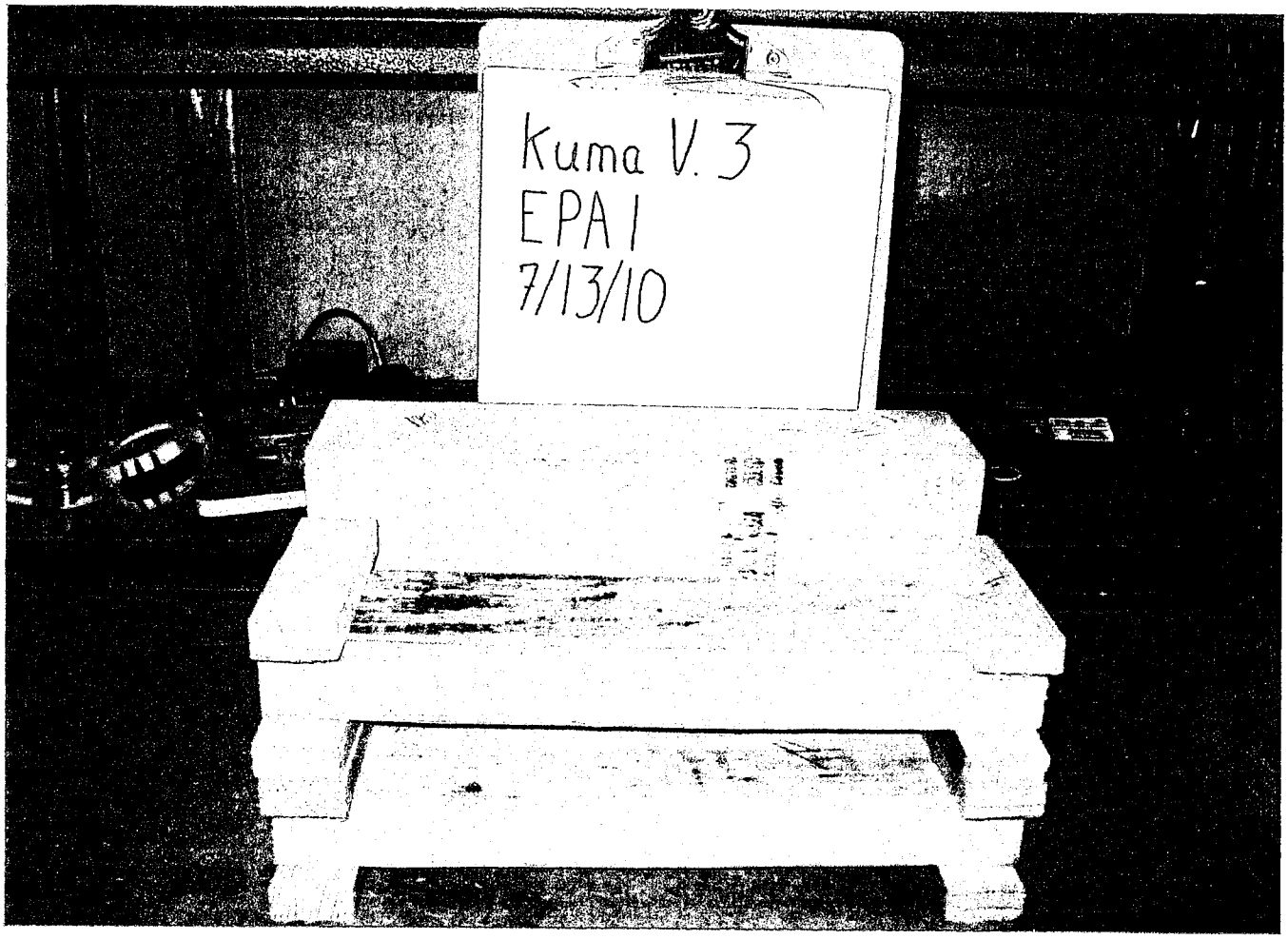
SEALED EPA TEST STOVE

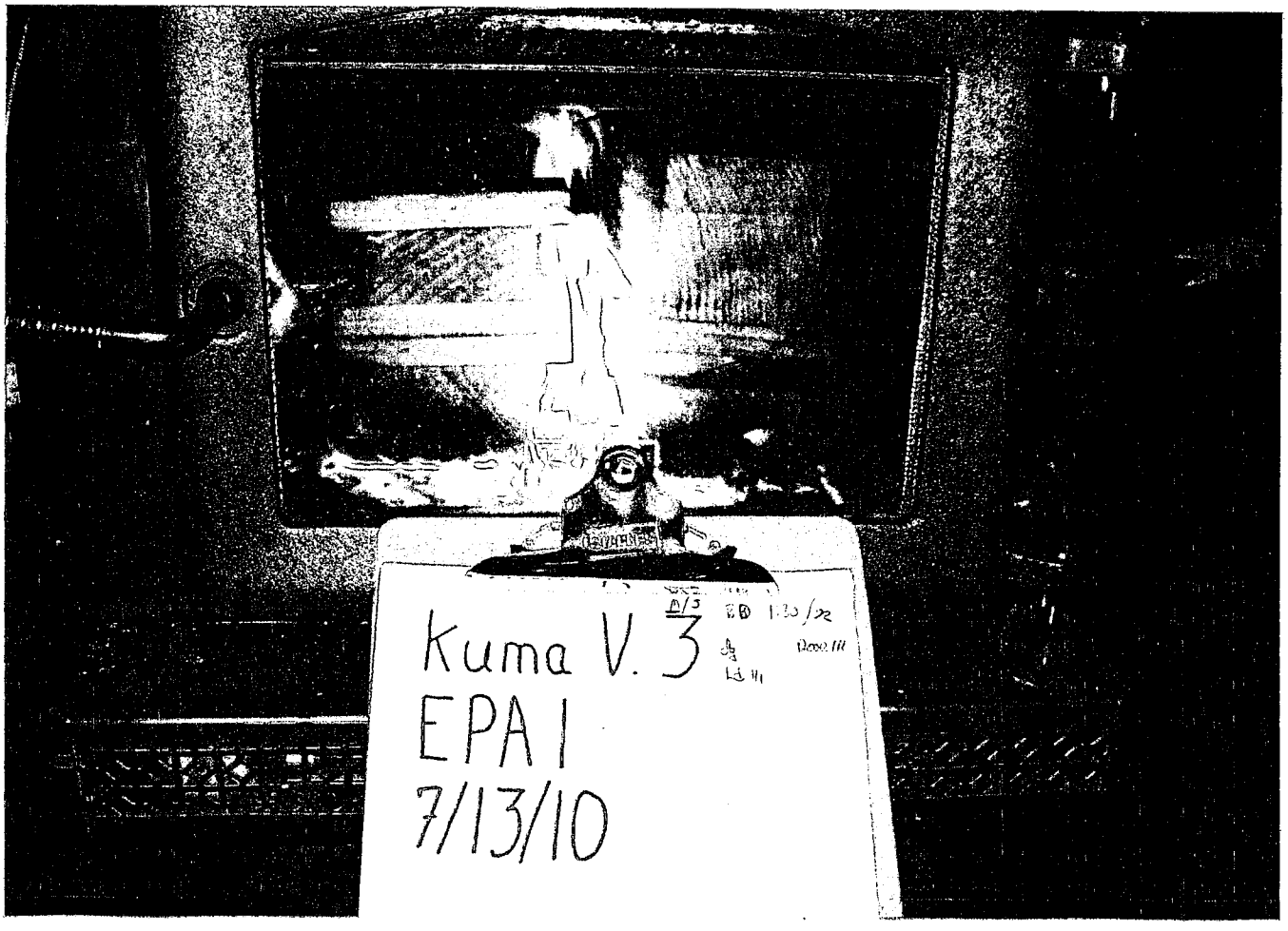
DO NOT OPEN OR TAMPER WITH THE SEALS AND PACKAGING ON THIS STOVE.

TO DO SO WILL VOID THE CERTIFICATION ON THIS STOVE.




KUMA
ASPEN


Kuma V. 3
EPA 1
7/13/10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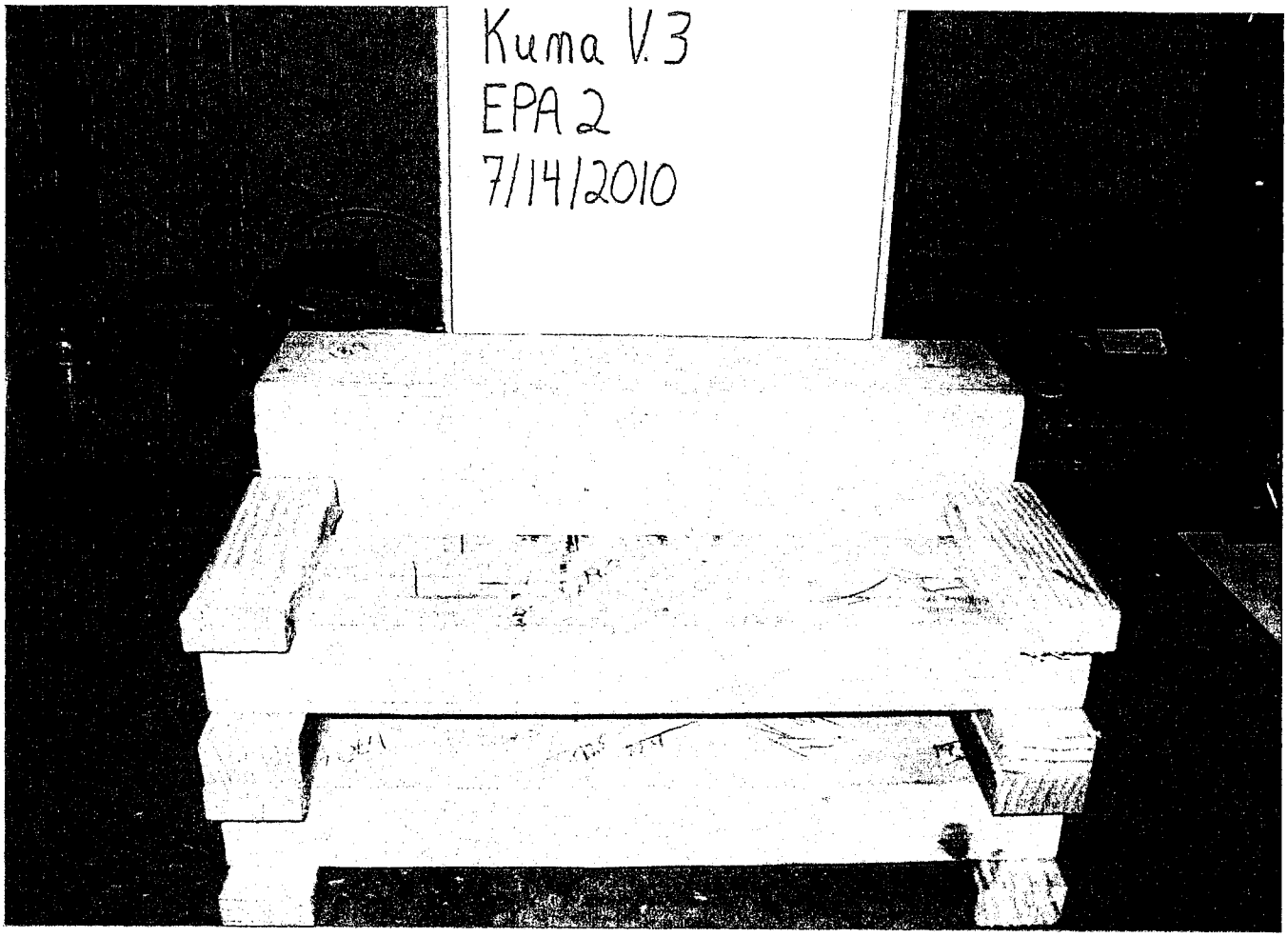
7/13/10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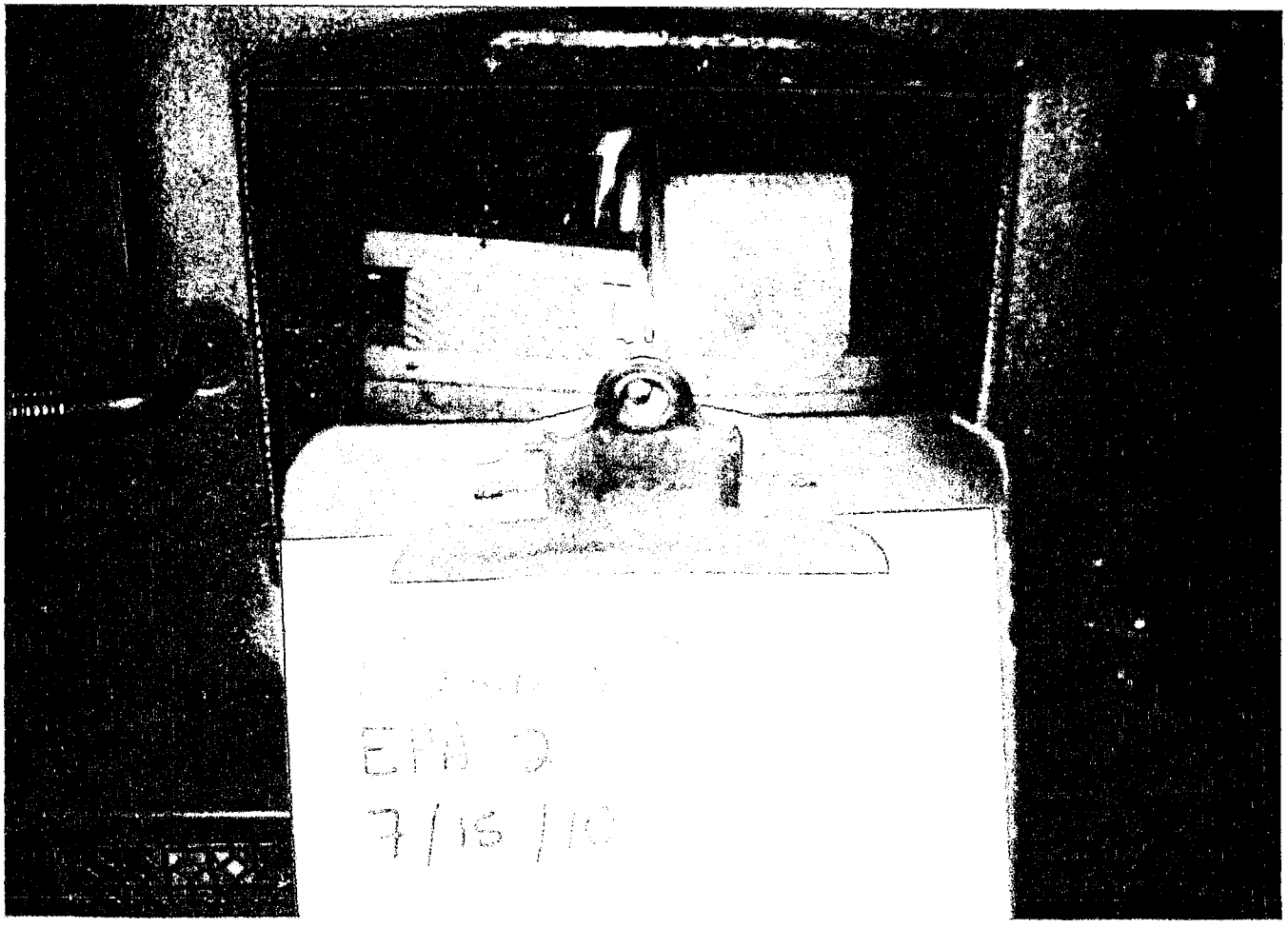
7/14/2010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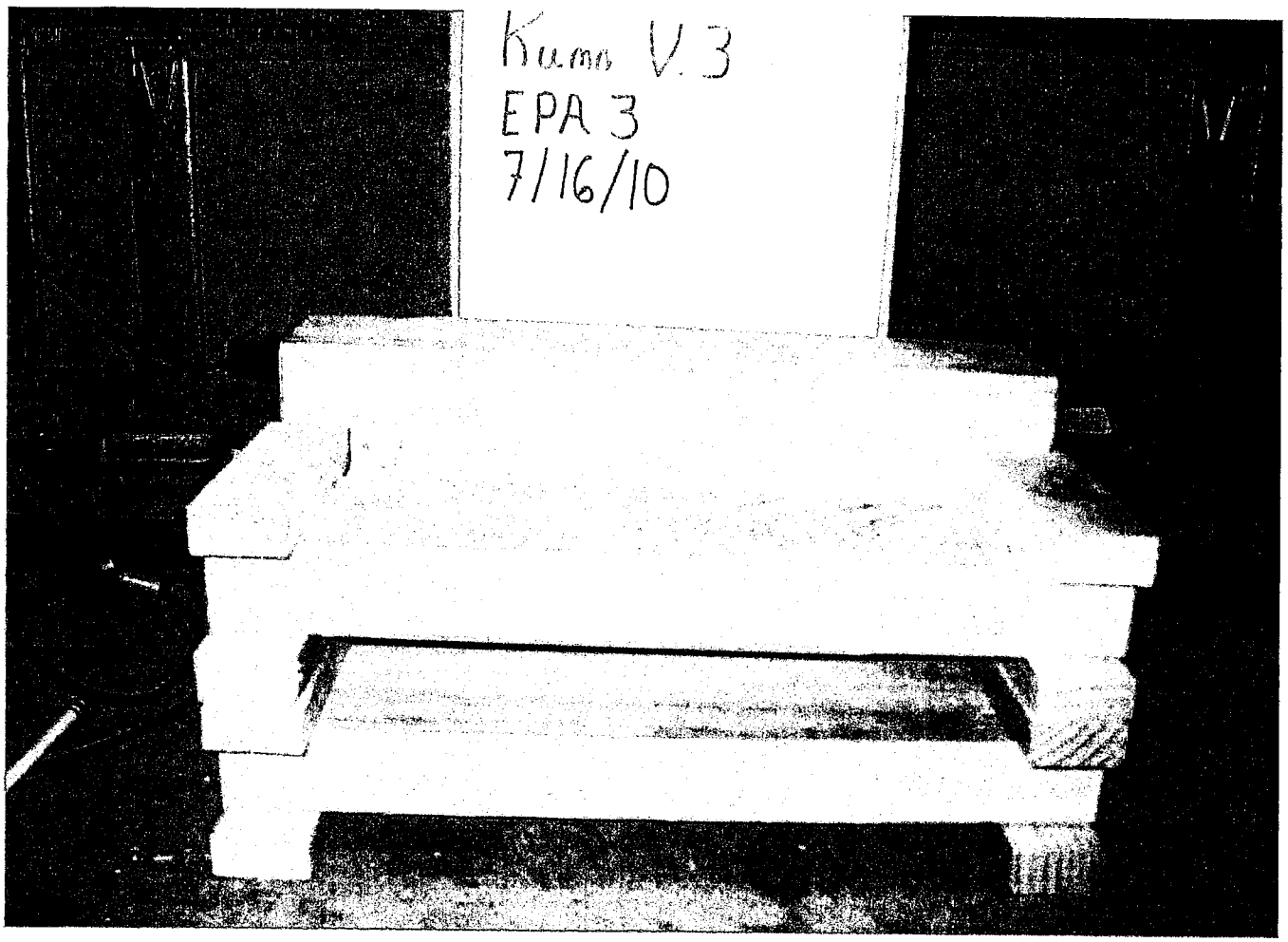
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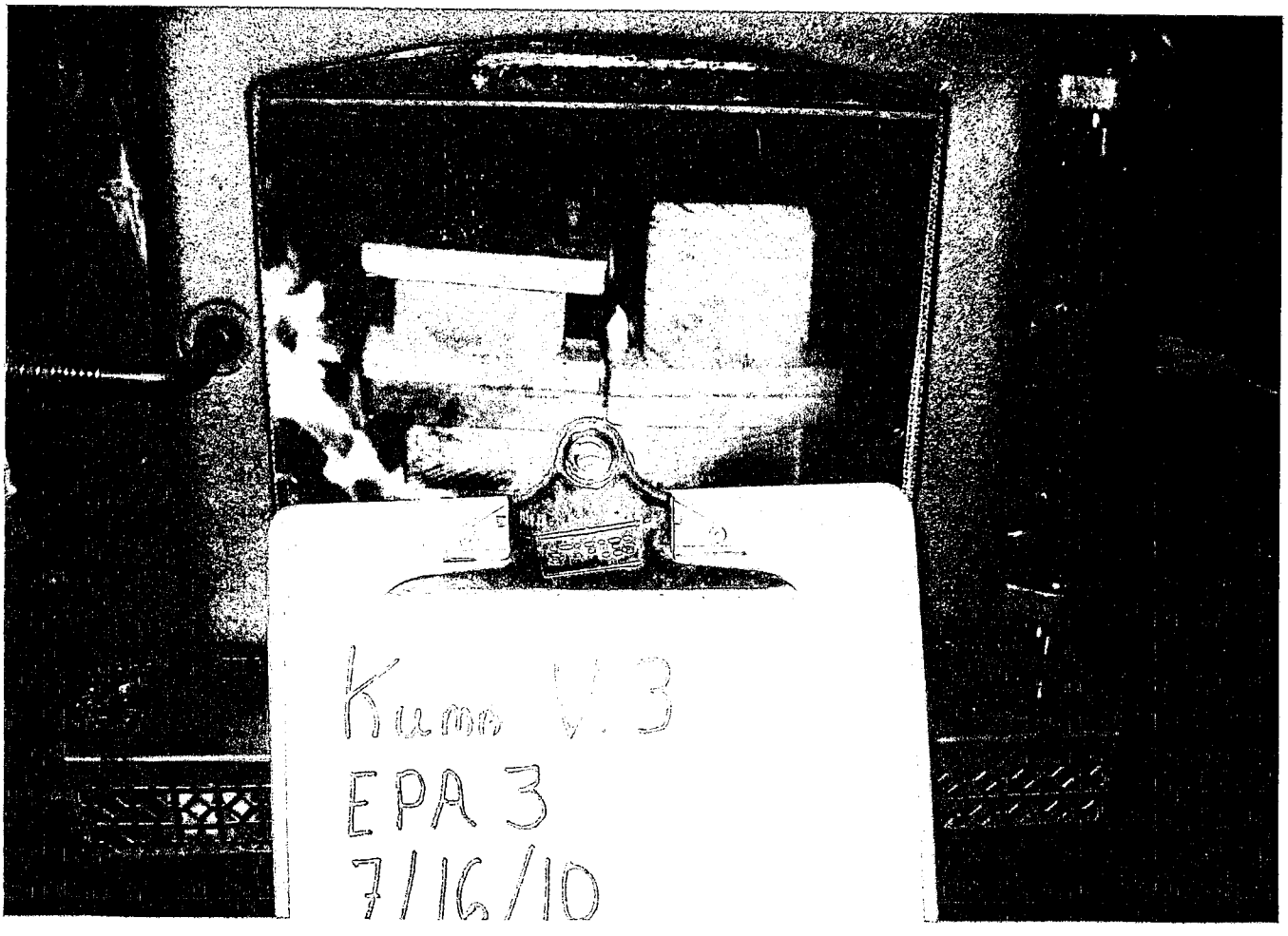
7/16/10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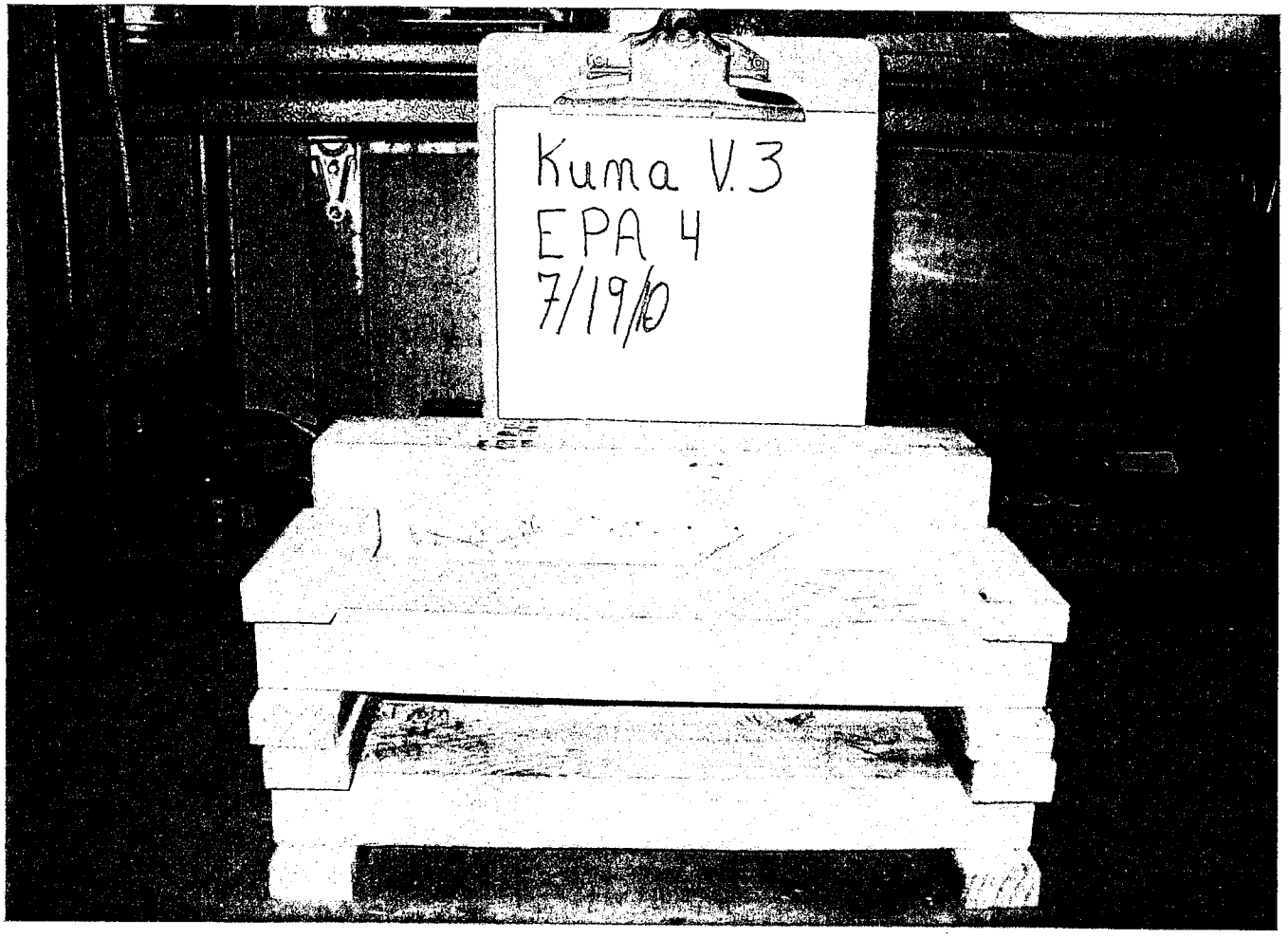
7/16/10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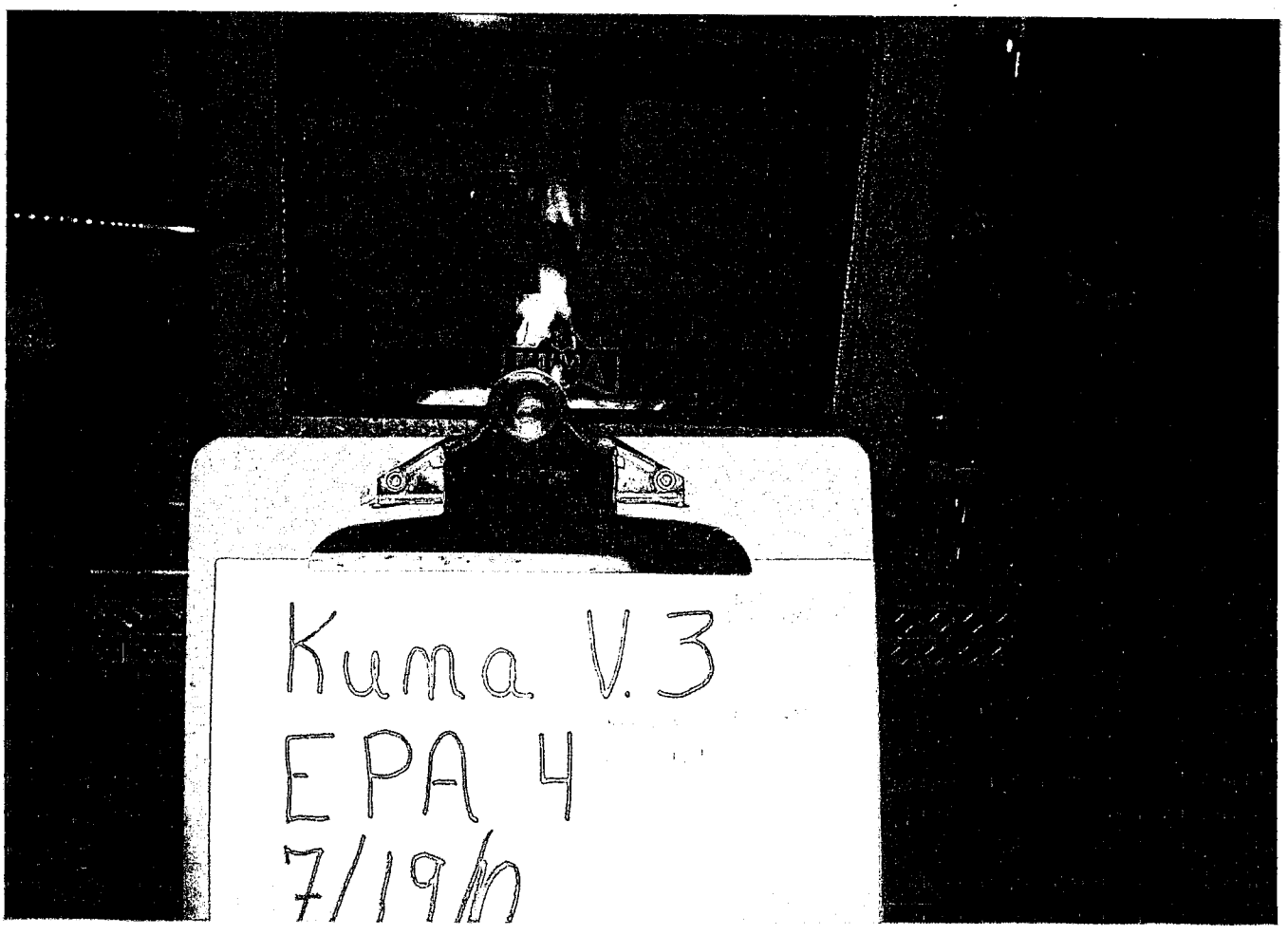
7/19/b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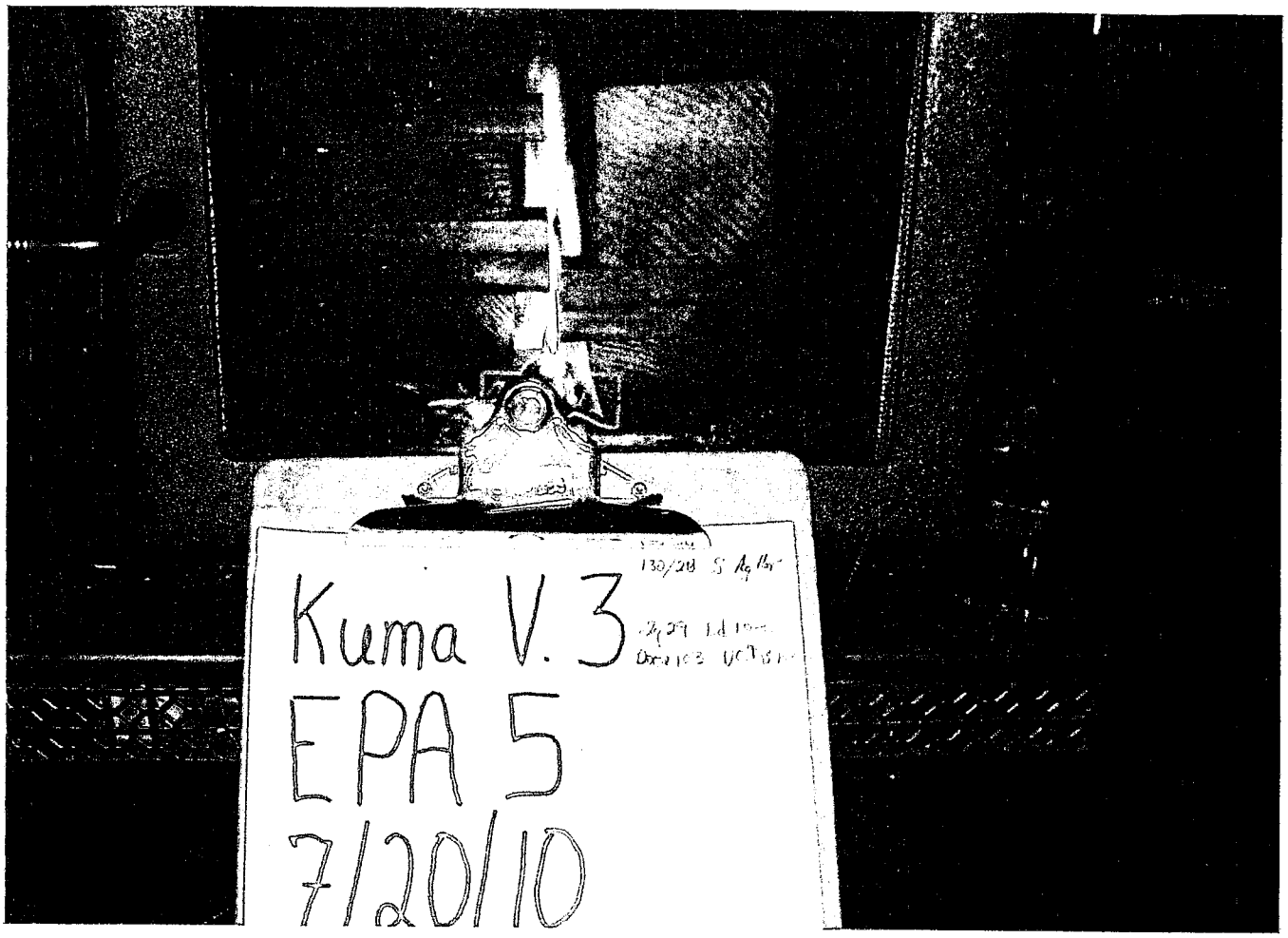
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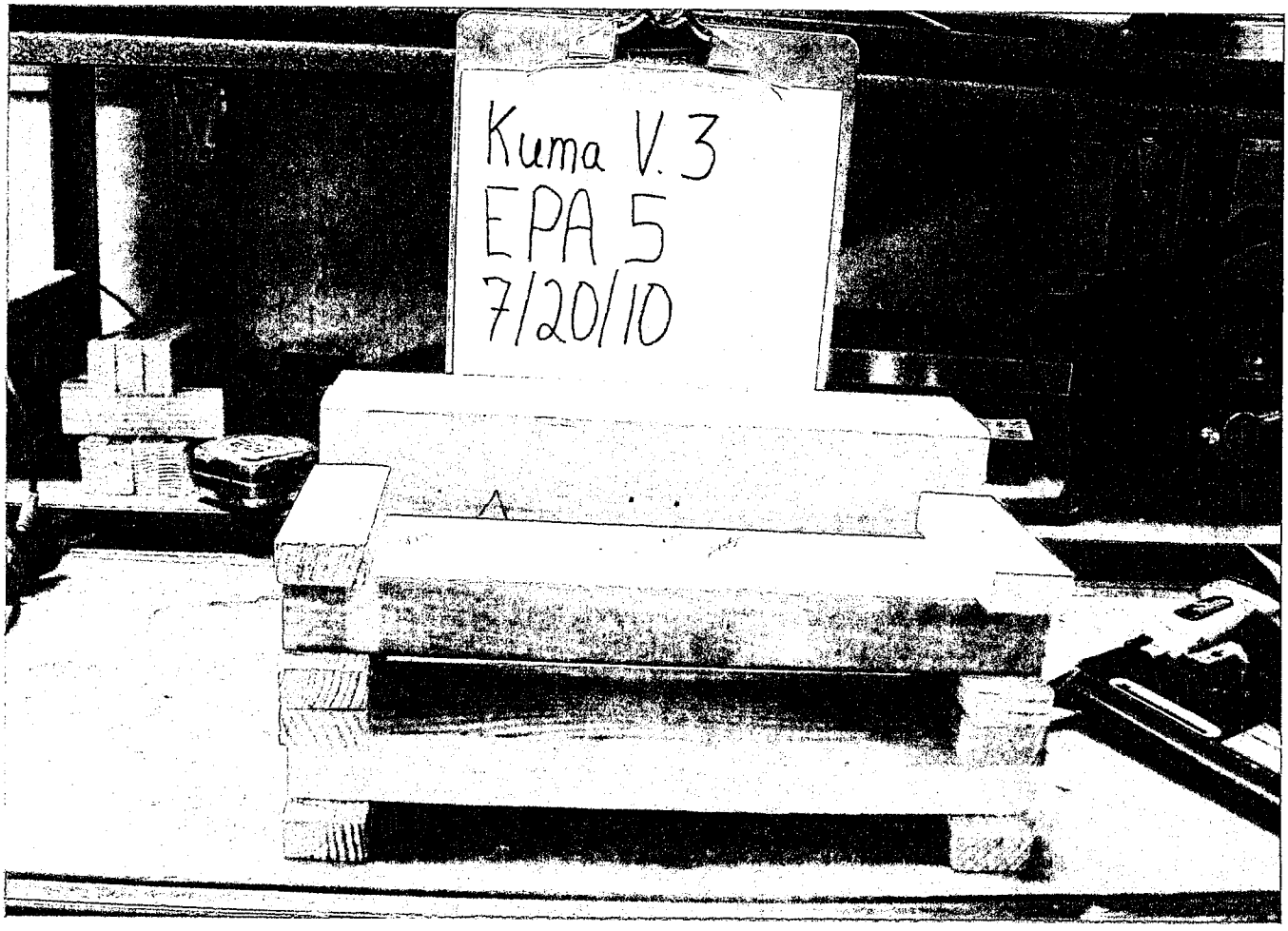
7/20/10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7/20/10