Non-Confidential Business Information (Non-CBI)

Certification Test Report

New Buck Corporation

Model: 91

Prepared for:	New Buck Corporation 200 Ethan Allen Drive Spruce Pine, NC 28777
Prepared by:	OMNI-Test Laboratories, Inc. 13327 NE Airport Way Portland, OR 97230 (503) 643-3788
Test Period:	May 28, 2019 – May 30, 2019
Report Issued:	August 15, 2019
Report Number:	0567WS001N

- Document Edition # 000 (8/15/19) -

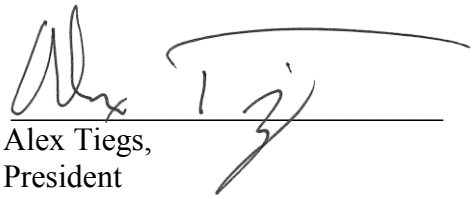
AUTHORIZED SIGNATORIES

This report has been reviewed and approved by the following authorized signatories:

Test Technician:

Bruce Davis,
Technician

Evaluator:



Alex Tiegs,
President

TABLE OF CONTENTS

Section 1

Sampling Procedures and Test Results

INTRODUCTION

New Buck Corporation retained *OMNI* to perform U.S. Environmental Protection Agency (EPA) certification testing on the 91 Freestanding woodstove. The 91 Freestanding wood stove is a Catalytic-type room heater. The firebox is constructed of mild steel. Usable firebox volume was measured to be 2.61 cubic feet and the stove is vented through 6" flue collar located on the stove top.

Testing was performed at Nelke Consulting, altitude of the laboratory is 500 feet above sea level. The unit was received in good condition and logged in on 5/27/19, then assigned and labeled with *OMNI* ID #2372. *OMNI* representative Bruce Davis conducted the certification testing and completed all testing by May 30, 2019.

This report is organized in accordance with the EPA-recommended outline and is summarized in the Table of Contents immediately preceding this section. The results in this report are limited to the item submitted.

SAMPLING PROCEDURE

The 91 wood stove was tested in accordance with the U.S. EPA 40 CFR Part 60, Subpart AAA – Standards of Performance for New Residential Wood Heaters using EPA Method 28R, ASTM E2515 and EPA Alt-125, ASTM E3053. Particulate emissions were measured using sampling trains consisting of two Teflon coated 47mm filters (front and back). See Appendix A for details on EPA Alt-125.

The model 91 was tested for thermal efficiency and carbon monoxide (CO) emissions in accordance with CSA B415.1-10 using Maple cordwood.

SUMMARY OF RESULTS

The weighted average emissions of the three test runs included in the results indicate a particulate emission rate of 1.82 grams per hour. Particulate emissions used in the weighted average were sampled on only one of the high burn fuel loads, test 3 was conducted to generate a coal bed for test number 4. The 91 results are within the emission limit of 2.5 g/h for affected facilities tested with cordwood, manufactured on or after May 15, 2020.

The proportionality results for all 3 test runs were acceptable. Quality check results for each test run are presented in Section 2 of this report.

INDIVIDUAL RUN SUMMARIES

Run 1 - Test procedures followed to produce a high burn rate with a primary air setting of fully open. Observed burn rate was calculated at 4.36 kg/hr. Emissions results were calculated using particulate sampling from kindling, start-up fuel, and test fuel load combined (cold to hot). Burn rate, and efficiency were calculated using data from the test fuel load only (hot to hot). No sampling anomalies occurred; this test run was determined to be valid for inclusion in the weighted average.

Run 2 - Test procedures were followed to produce a low burn rate with a primary air setting of full closed. Observed burn rate was calculated at 0.46 kg/hr. Emissions and efficiency results were calculated using a hot to hot burn cycle, a coal bed generated by the high burn procedure was used. No sampling anomalies occurred; this test run was determined to be valid for inclusion in the weighted average.

Run 3 - Test procedures followed to produce a high burn rate with a primary air setting of fully open. Observed burn rate was calculated at 4.52 kg/hr. Burn rate, was calculated using data from the test fuel load only (hot to hot). No sampling occurred during this test; it was conducted to generate a coal bed for test number 4.

Run 4 - Test procedures were followed to produce a medium high burn rate with a primary air setting of 0.125” (1/8”) open. Observed burn rate was calculated at 0.71 kg/hr. Emissions and efficiency results were calculated using a hot to hot burn cycle, a coal bed generated by the high burn conducted in test three was used. No sampling anomalies occurred; this test run was determined to be valid for inclusion in the weighted average.

Table 1 – Particulate Emissions

Run	**Burn Rate** Calculated from a Hot to Hot burn cycle (kg/h dry)	**ASTM E2515 Emissions** (g/h)	**ASTM E3053 Weighting Factor** (%)	**ASTM E3053 Weighted Emissions** (g/h)
1	4.36	[1]6.80	20	1.36
2	0.54	0.46	40	0.184
4	0.62	0.70	40	0.280
The sum of weighted particulate emission of 3 test runs, tests 1,2, and 4: 1.36 + 0.184 + 0.280 = **1.82** grams per hour.				

Note: [1] Based on a cold start including kindling and start-up fuel.

Table 2 – Particulate Emissions (First Hour)

Run	**ASTM E2515 Emissions – First Hour** (g/h)
1	7.57
2	2.37
4	4.19

Table 3 – B415.1 Efficiency and CO Emissions

Run	Heat Output (BTU/h)	HHV Efficiency (%)	LHV Efficiency (%)	CO Emissions (g/MJ Output)	CO Emissions (g/kg Dry Fuel)	CO Emissions (g/min)
1	62,745	74.1	79.3	1.48	24.35	0.641
2	8,500	83.5	90.3	0.98	16.29	0.147
4	9,428	80.3	86.8	0.94	14.97	0.156
Weighted average HHV efficiency of three test runs: 14.82 + 33.4 + 32.12 = **80.3%**. Average CO Emissions of three tests: (0.641 + 0.147 + 0.1558) / 3 = **0.315 g/min**						

Table 4 – Test Facility Conditions

Run	Room Temperature (°F)		Barometric Pressure (Hg)		Air Velocity (ft/min)	
	Before	**After**	**Before**	**After**	**Before**	**After**
1	66	78	29.46	29.46	<50	<50
2	78	68	29.45	29.39	<50	<50
3	64	80	29.33	29.34	<50	<50
4	82	66	29.34	29.39	<50	<50

Table 5 – Kindling and Start-up Fuel Description Summary
Maple Cordwood

Run	Kindling Weight Wet Basis (lbs)	Start-up Fuel Weight Wet Basis (lbs)	Residual Start-up fuel weight (lbs)
1	4.80	7.30	2.5
3	5.10	7.70	2.8

Note: Test 3 was a high burn used to create a coal bed for test number 4, no particulate sampling occurred during this test.

Table 6 – Fuel Measurement and Cordwood Description Summary – TEST
Maple Cordwood

Run	**Test Fuel Wet Basis** (lbs)	**Firebox Volume** (ft^3)	**Fuel Loading Density Wet Basis** (lbs/ft^3)	**Test Fuel Dry Basis** (lbs)	**Test Fuel Consumed During Test Dry Basis (lbs)**	**Piece Length** (in)
1	25.00	2.61	9.6	20.65 + 10.32	25.8	5@16
2	30.20	2.61	11.6	24.95	24.3	5@16
3	25.70	2.61	9.8	20.95 + 10.9	26.3	5@16
4	30.00	2.61	11.5	24.31	24.0	5@16

Table 7 – Dilution Tunnel Gas Measurements and Sampling Data Summary

Run	**Length of Test** (min)	**Average Dilution Tunnel Gas Measurements**		
		Velocity (ft/sec)	**Flow Rate** (dscf/min)	**Temperature** (°F)
1	172	21.89	229.1	113
2	1230	18.91	210.8	77
4	1050	18.58	205.0	82

Table 10 – Test Configurations

Run	Startup Procedures	Combustion Air
1	Fuel Loading: Kindling and start-up fuel loaded together, a torch was used for 40 seconds to establish a fire. At 58 minutes placed fuel load into the firebox and closed the loading door. Loading required less than 1 minute to complete. Door: For kindling and start-up fuel, loading door was closed by 2.00 minutes. Test fuel load; fuel loading door was closed by 1:00 minute. Primary Air: Air control fully open for the entire test. Boost Air: During kindling and start-up, boost air was open until 3:00 minutes then fully closed. During fuel load test, boost air was not used. Fan: Fan turned onto high 38 minutes after starting kindling fire, remained on high for the entire test. Bypass: Open during ignition of kindling until 3:00 minutes, and open until 1:00 minute during fuel load loading.	Fully open for entire test.
2	Fuel Loading: Test fuel loaded onto coal bed generated by test number 1 by 50 seconds. Door: Closed by 60 seconds. Primary Air: Fully open, then set to full closed by 10.0 minutes. Boost Air: Boost air fully open until 5 minutes then fully closed. Fan: Fan on low entire test. Bypass: Not used for loading test fuel load.	Fully open for first 10 minutes, then set to Full Closed.
3	Fuel Loading: Kindling and start-up fuel loaded together, a torch was used for 40 seconds to establish a fire. At 62 minutes placed fuel load into the firebox and closed the loading door. Loading required less than 1 minute to complete. Door: For kindling and start-up fuel, loading door was closed by 2.00 minutes. Test fuel load; fuel loading door was closed by 1:00 minute. Primary Air: Air control fully open for the entire test. Boost Air: During kindling and start-up, boost air was open until 3:00 minutes then fully closed. During fuel load test, boost air was not used. Fan: Fan turned onto high 38 minutes after starting kindling fire, remained on high for the entire test. Bypass: Open during ignition of kindling until 3:00 minutes, and open until 1:00 minute during fuel load loading.	Fully open for entire test.
4	Fuel Loading: Test fuel loaded onto coal bed generated by test number 3 by 60 seconds. Door: Closed by 60 seconds. Primary Air: Fully open, then set to 0.125” by 7.0 minutes. Boost Air: Boost air fully open until 5 minutes then fully closed. Fan: Fan on medium entire test. Bypass: Not used for loading test fuel load.	Fully open for first 7.0 minutes, then set to 0.125”.

Section 2

Photographs/Appliance Description/Drawings

New Buck Corporation
Model 91
Test Dates: May 28, 2019 – May 30, 2019

New Buck Corporation
Model 91

Run 1 – Kindling and start-up fuel

Run 1 – Kindling and start-up fuel

Run 1 – Ignition of kindling

Run 1 – Fuel load

New Buck Corporation
Model 91

Run 1 – Test Fuel Load In Stove

Run 1 – Remaining Coal After Test

Run 2 – Test Fuel Load

Run 2 – Test Fuel Loaded into Stove

Run 2 – Remaining Coal After Test

Run 3 – Kindling and start-up fuel

Run 3 – Test Fuel Load

Run 3 – Test Fuel Loaded into Stove

Run 3 - Remaining Coal After Test

Run 4 – Test Fuel Load

Run 4 – Coal bed prior to loading

Run 4 – Test Fuel Loaded into Stove

Run 4 – Fuel Prior to Adjustment

Run 4 – Fuel After Adjustment

Run 4 – Remaining Coal After Test

WOOD HEATER DESCRIPTION

Appliance Manufacturer: New Buck Corporation

Wood Stove Model: 91

Type: Freestanding Catalytic Wood Fired Room Heater

WOOD HEATER INFORMATION

Materials of Construction: The unit is constructed primarily of mild steel. The firebox is lined with fire brick that measures 4.5" x 9.0". The feed door has a 11.1875 x 17.5 glass panel and 3/4" fiberglass rope gasket.

Air Introduction System: Air is introduced into three different areas of the fire chamber and is controlled by two sliding control rods. Secondary air is introduced into the fire box through the bottom, it is then channeled up into the secondary air tubes located under the baffle. Air wash air is introduced through an opening in the bottom of the fire box. It is then channeled up to a manifold across the top of the door, air is directed down across the glass and into the fire chamber. Some of the primary air is directed from the rear of the manifold above the door, directly into the firebox near the catalyst. A lower primary air orifice (Shotgun) is mounted on the firebox floor near the loading door. Air is routed through the bottom of the firebox and into the lower orifice manifold, it is then directed horizontally into the coal bed near the front of the combustion chamber.

Combustion Control Mechanisms: Combustion air control mechanism is two sliding rods with flat plates attached that cover and uncover air inlets when the rod is pushed in or pulled out. One control is for primary air, and the second operates the lower shotgun air.
Combustor: Three Applied Ceramics 25 cell per inch combustors are used, each combustor measures 2" x 3.5" x 6.0". All three combustors are placed into one housing and wrapped with a ceramic gasket.

Internal Baffles: A ¼" hot rolled steel plate is used to mount the combustor and bypass door. A sliding flue bypass is incorporated into the baffle, when opened it allow products of combustion to bypass the catalyst and flow directly to the flue outlet. When closed products of combustion are directed through the catalyst mounted near the front of the baffle system.
Other Features: A 160 CFM room air fans are offered as optional equipment; tested model had a variable speed control mounted in the power supply cord.

Flue Outlet: The 6" diameter flue outlet is located at the rear of the top of the appliance.

WOOD HEATER OPERATING INSTRUCTIONS

Specific Written Instructions: See Section 4 of this report. All markings and instruction materials were reviewed for content prior to printing.

Section 3

Test Data by Run

New Buck 91 High Burn Procedure

Kindling:

Kindling weight in total should be 4.0lbs (±1.0bs) 12 pieces in total of equal size, 15-17'' in length. Making sure the weight doesn't exceed what's allowed per the standard.

Start-up Fuel:

The start-up fuel consists of five pieces of equal size with a total weight of 7.0lbs (±0.5lbs) and a length of 15-17''.

Test Fuel:

The test fuel consists of five pieces with a nominal length of 16''. Follow the fuel sheet guideline for specific weights of the core and remainder loads.

Test fuel:

Start-up Procedure:

The start-up fuel is comprised of five layers as follows.

Bottom: Two start-up pieces East/West

2nd: Three start-up pieces with two kindling pieces in-between North/South

3rd: Six kindling pieces East/West

4th: Four kindling pieces North/South

Top: 0.6lbs – 0.5lbs pile of small kindling pieces in the middle as shown in the picture below, (4-5 Layers).

Kindling and Start-up:

Open the by-pass and use a torch for 40 seconds to one minute to ignite the fuel, focusing the torch on the top middle portion of the load. Leave the door open around two inches for 1.5 to 2.5 minutes. After three to four minutes, close the by-pass. The amount of time for both the door and the by-pass are to be based on how involved the fuel is.

Set the fan control to the high position and it will turn on around 35-45 minutes.

The test load should be loaded at the bottom end of the allowable coal bed within 0.2lbs.

When loading, use the smaller of the test pieces to gently level the remaining fuel. Use the by-pass if needed. Place the smallest piece as far back as possible in an East/West direction. The remaining four pieces shall be places in a North/South direction with minimal gaps between each piece. See test fuel picture for example. The door should be open ≤ one minute. Once it's loaded, close the door and by-pass if used.

End the test at the high end of the allowable remaining weight.

New Buck 91 Medium and Low Procedure

Test Fuel:

Follow the guidelines of the cordwood standard (E3053-17) for correct moisture and weight ratios for the core and sub loads. There are five pieces in total. The nominal length is 16’’.

Coal Bed:

The coal bed will always result in running a high burn. There may be large pieces of fuel left after the high burn, as soon as the high burn has been complete, move the larger raw pieces toward the middle of the firebox stacked up for best combustion. Load the test fuel at the very low end of the coal bed within 0.2lbs. This allows more room to place the fuel.

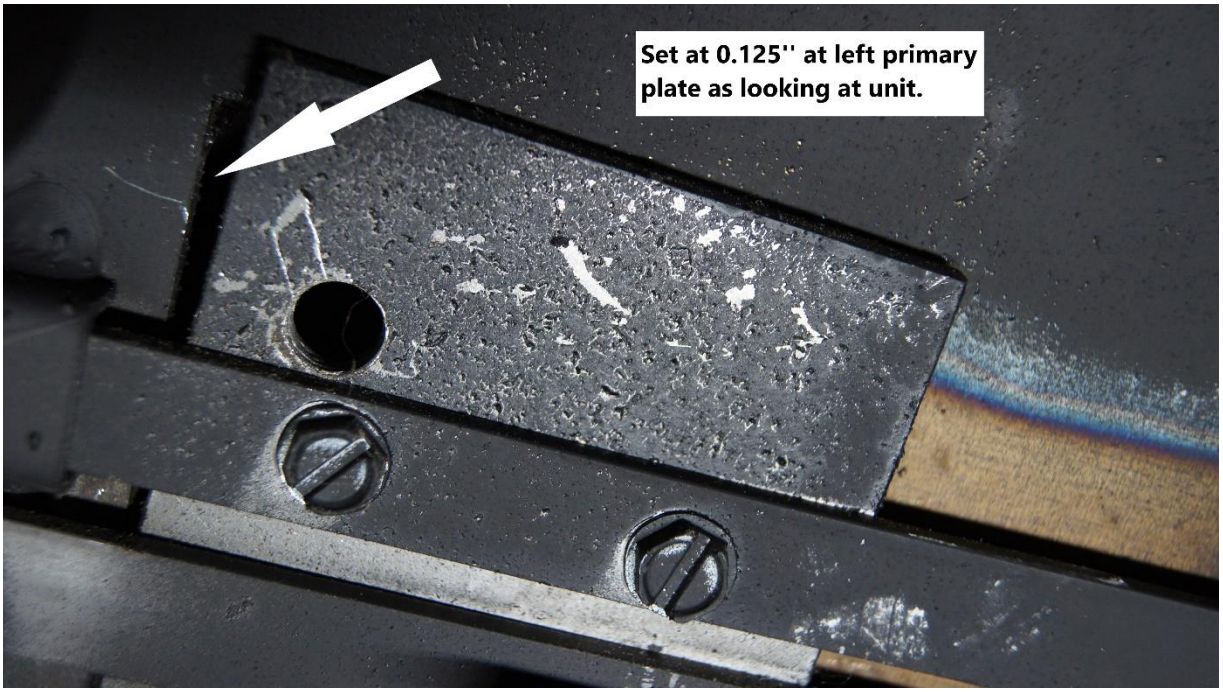
Fuel Loading & Settings:

Level the coal bed before you start sampling. If there happens to be any raw pieces left over, place them in the very rear as seen in the picture above. The Fan is turned on after the fuel is loaded and the door is shut and is set on low for the low burn, medium for the medium burn. Use the by-pass at the start of the test if needed. There should be minimal gaps between all fuel pieces. A medium sized piece in the very back in an East/West direction and the remaining four pieces in a North/South direction in front of the rear piece with minimal gaps (see test fuel picture above). The door should be open less than one minute. Close the shotgun air at five minutes. Keep the primary control open for 5-10 minutes, making sure the stove is burning clean and the catalyst is above 900° Fahrenheit before you shut down the burn setting. If you see the combustion getting noticeably dirtier, set the control at the desired setting.

The setting for the low is all the way closed.

The setting for the medium burn is 0.125'' on the left primary air plate as looking at the unit. See picture below.

Medium Setting:



Moving Fuel Load:

It may be necessary to move the fuel load at some point during the medium and low burns. Keep an eye on weight drop and stack draft to determine when to move the fuel if needed.

Run 1

High Burn 2-minute data

Emissions Results (Cold to Hot Cycle)

Wood Heater Test Data

Run: 1

Manufacturer: New Buck Stoves
Model: 91
Tracking No.: 2372
Project No.: 0567WS001N
Test Date: 28-May-19
Beginning Clock Time: 10:26

Total Sampling Time: 172 min
Recording Interval: 2 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.009 (1) 0.996 (2) _____ (Amb)

Barometric Pressure:	Begin	Middle	End	Average
	29.46	29.46	29.46	29.46 0

OMNI Equipment Numbers: _____

PM Control Modules: 371, 372
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.270 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 21.89 ft/sec.
Initial Tunnel Flow: 237.3 scfm
Average Tunnel Flow: 229.1 scfm
Post-Test Leak Check (1): 0.000 cfm @ 8 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 10 in. Hg
Average Test Piece Fuel Moisture: 21.25 Dry Basis %

Technician Signature:

Velocity Traverse Data	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.078	0.104	0.112	0.096	0.076	0.106	0.112	0.102	0.114	"H2O
Temp:	68	68	68	68	68	68	68	68	68	°F

V_{strav} 20.89 ft/sec V_{scent} 22.56 ft/sec F_p 0.926

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)													Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface	Catalyst Exit	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
0	0.000	0.000			1.54	67	0.4	1.87	67	-0.4	68	0.117			12.1		64	62	63	63	63	63	62	66	84	61	84	60	66	0.000	0.79	0
2	0.251	0.310	0.13	0.16	1.53	67	0.28	1.61	67	-0.3	147	0.109	97	99	11.8	-0.3	64	62	63	64	64	63	70	248	84	54	83	53	66	0.018	0.51	0
4	0.522	0.636	0.14	0.16	1.65	67	0.24	1.64	67	-0.5	78	0.118	95	94	11.6	-0.22	64	62	63	64	64	63	118	219	84	54	83	52	66	0.019	3.41	0.63
6	0.796	0.969	0.14	0.17	1.62	68	0.39	1.63	67	-0.4	74	0.116	96	96	11.4	-0.18	64	62	64	64	64	64	191	155	82	53	82	52	66	0.003	8.71	0.43
8	1.065	1.300	0.13	0.17	1.58	68	0.15	1.59	67	-0.6	75	0.117	94	95	11.1	-0.3	65	62	65	65	65	64	328	168	82	53	81	51	66	0.012	9.03	0.32
10	1.333	1.626	0.13	0.16	1.55	68	0.13	1.55	67	-0.6	79	0.120	93	93	10.7	-0.4	67	62	66	67	66	66	472	208	82	53	81	51	66	0.023	12.7	0.38
12	1.611	1.959	0.14	0.17	1.60	68	0.02	1.68	67	-0.5	83	0.121	97	95	10.2	-0.5	70	62	67	69	68	67	605	257	83	52	82	51	66	0.034	13.97	0.14
14	1.885	2.291	0.14	0.17	1.67	68	0.21	1.63	67	-0.5	86	0.117	97	97	9.6	-0.6	75	62	69	72	70	70	739	304	83	52	83	51	66	0.042	14.08	0.48
16	2.153	2.628	0.13	0.17	1.64	68	0.21	1.55	67	-0.6	87	0.113	97	100	9.1	-0.5	82	62	71	75	73	73	781	334	83	52	83	50	67	0.046	13.4	0.43
18	2.418	2.967	0.13	0.17	1.68	68	0.09	1.55	67	-0.7	90	0.116	95	100	8.7	-0.4	91	62	74	79	76	76	769	350	83	53	83	50	67	0.048	11.92	0.07
20	2.685	3.306	0.13	0.17	1.68	68	0.13	1.61	68	-0.7	92	0.116	96	100	8.3	-0.38	102	63	76	83	80	81	755	358	83	53	83	50	67	0.049	11.31	0.04
22	2.955	3.644	0.14	0.17	1.68	68	0.08	1.60	68	-0.7	94	0.116	97	99	8.0	-0.32	114	63	79	88	85	86	735	365	84	53	83	50	67	0.049	9.93	0.04
24	3.224	3.982	0.13	0.17	1.68	69	0.18	1.58	68	-0.4	95	0.113	98	101	7.7	-0.3	126	63	83	92	89	91	722	369	84	53	84	51	68	0.050	9.38	0.04
26	3.493	4.320	0.13	0.17	1.66	69	0.15	1.58	68	-0.6	97	0.115	97	100	7.4	-0.3	139	64	86	97	93	96	724	375	84	54	84	51	67	0.051	10.55	0.05
28	3.761	4.658	0.13	0.17	1.66	69	0.16	1.56	68	-0.7	99	0.113	98	101	7.1	-0.3	152	65	90	101	98	101	736	385	84	54	84	51	67	0.052	9.86	0.03
30	4.029	4.996	0.13	0.17	1.69	69	0.15	1.63	68	-0.7	99	0.114	97	101	6.8	-0.3	164	65	94	106	103	106	723	391	84	54	85	51	67	0.053	9.95	0.03
32	4.302	5.336	0.14	0.17	1.68	69	0.07	1.61	68	-0.6	100	0.111	100	103	6.4	-0.4	177	67	99	110	108	112	718	397	85	54	85	51	67	0.054	9.33	0.03
34	4.575	5.677	0.14	0.17	1.70	69	-0.1	1.63	68	-0.6	102	0.112	100	103	6.1	-0.28	189	68	103	115	112	117	734	405	85	55	85	52	68	0.055	8.4	0.04
36	4.847	6.017	0.14	0.17	1.68	69	-0.17	1.60	69	-0.5	103	0.115	98	101	5.9	-0.22	200	69	108	119	116	122	751	411	85	55	85	52	68	0.056	7.96	0.03
38	5.118	6.356	0.14	0.17	1.68	70	0.02	1.60	69	-0.6	103	0.116	98	100	5.6	-0.3	211	71	112	123	120	127	741	412	85	55	85	52	68	0.056	8.31	0.03
40	5.388	6.694	0.14	0.17	1.67	70	-0.17	1.60	69	-0.6	107	0.112	99	102	5.2	-0.4	220	73	109	127	121	130	763	426	85	55	85	52	70	0.057	9.06	0.05
42	5.657	7.032	0.13	0.17	1.64	70	0.05	1.60	69	-0.6	107	0.119	96	99	4.9	-0.3	224	75	107	129	123	132	777	429	85	56	85	53	70	0.058	8.96	0.05
44	5.928	7.367	0.14	0.17	1.65	70	-0.19	1.57	69	-0.7	108	0.113	99	101	4.5	-0.4	227	77	106	131	124	133	772	432	86	56	85	53	70	0.058	9.35	0.03
46	6.199	7.703	0.14	0.17	1.65	70	0.09	1.60	69	-0.8	109	0.113	99	101	4.2	-0.3	227	78	106	132	125	134	781	435	86	57	85	53	71	0.059	9.71	0.04
48	6.467	8.038	0.13	0.17	1.64	71	-0.16	1.59	70	-0.6	110	0.108	100	103	3.9	-0.3	228	80	106	134	127	135	778	438	86	57	85	54	71	0.059	9.42	0.03
50	6.737	8.372	0.14	0.17	1.62	71	-0.16	1.59	70	-0.6	110	0.113	99	101	3.6	-0.3	228	81	107	135	128	136	771	440	86	57	85	54	71	0.058	9.06	0.03
52	7.007	8.706	0.14	0.17	1.63	71	0.02	1.58	70	-0.8	110	0.117	97	99	3.3	-0.3	228	82	107	137	129	137	756	438	86	58	85	55	72	0.058	9.19	0.03
54	7.276	9.040	0.13	0.17	1.62	71	0.08	1.60	70	-0.8	111	0.114	98	100	3.0	-0.3	228	83	108	139	130	138	752	437	86	58	85	55	72	0.058	8.74	0.02
56	7.546	9.375	0.14	0.17	1.64	72	-0.24	1.60	71	-0.7	111	0.109	101	103	2.7	-0.3	228	84	108	141	131	138	747	437	86	58	85	55	72	0.058	8.51	0.01
58	7.817	9.711	0.14	0.17	1.71	72	-0.01	1.57	71	-0.5	110	0.107	102	104	2.4	-0.3	227	85	109	143	131	139	742	432	86	59	85	56	72	0.057	8.26	0.02
60	8.084	10.031	0.13	0.16	1.25	72	-0.66	1.50	71	-0.7	124	0.105	102	101	24.8	22.4	228	86	112	145	133	141	673	393	89	59	88	56	72	0.052	4.6	0.1
62	8.352	10.316	0.13	0.14	1.57	72	-4.51	1.44	71	-0.2	114	0.108	101	88	24.5	-0.3	228	88	111	145	132	141	670	408	86	59	86	56	72	0.057	5.1	0.03
64	8.619	10.620	0.13	0.15	1.85	73	-4.27	1.58	71	-0.3	112	0.109	99	93	24.2	-0.3	227	89	110	144	131	140	695	411	87	60	84	58	73	0.057	5.13	0.03
66	8.887	10.958	0.13	0.17	1.65	73	0.33	1.55	72	-0.3	111	0.113	98	102	24.0	-0.2	226	90	109	142	130	139	700	410	87	60	85	57	73	0.057	5.37	0.03
68	9.157	11.297	0.14	0.17	1.66	73	0.19	1.60	72	-0.3	111	0.115	98	101	23.6	-0.4	224	91	108	139	129	138	688	405	88	60	85	57	73	0.056	5.17	0.03
70	9.427	11.634	0.14	0.17	1.64	73	-0.03	1.59	72	-0.6	112	0.108	101	104	23.1	-0.54	223	91	107	137	128	137	856	414	88	61	85	58	73	0.058	5.19	0.03
72	9.696	11.967	0.13	0.17	1.60	73	0.22	1.57	72	-0.3	115	0.111	99	101	22.5	-0.56	222	92	107	135	129	137	1077	439	89	61	85	58	73	0.061	5.82	0.27

Wood Heater Test Data

Run: 1

Manufacturer: New Buck Stoves
Model: 91
Tracking No.: 2372
Project No.: 0567WS001N
Test Date: 28-May-19
Beginning Clock Time: 10:26

Total Sampling Time: 172 min
Recording Interval: 2 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.009 (1) 0.996 (2) _____ (Amb)

Barometric Pressure:	Begin	Middle	End	Average
	29.46	29.46	29.46	29.46

0

OMNI Equipment Numbers: _____

PM Control Modules: 371, 372
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.270 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 21.89 ft/sec.
Initial Tunnel Flow: 237.3 scfm
Average Tunnel Flow: 229.1 scfm
Post-Test Leak Check (1): 0.000 cfm @ 8 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 10 in. Hg
Average Test Piece Fuel Moisture: 21.25 Dry Basis %

Technician Signature: _____

Velocity Traverse Data	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.078	0.104	0.112	0.096	0.076	0.106	0.112	0.102	0.114	"H2O
Temp:	68	68	68	68	68	68	68	68	68	°F

V_{strav} 20.89 ft/sec V_{scent} 22.56 ft/sec F_p 0.926

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)													Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface	Catalyst Exit	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
74	9.963	12.296	0.13	0.16	1.58	74	0	1.53	73	-0.7	116	0.107	100	102	21.9	-0.6	224	93	106	133	129	137	1172	453	88	61	85	58	74	0.063	12.55	0.4
76	10.233	12.634	0.14	0.17	1.66	74	-0.05	1.57	73	-0.6	117	0.109	101	104	21.4	-0.5	228	93	106	132	131	138	1177	462	89	62	85	59	74	0.064	13.08	0.47
78	10.502	12.971	0.13	0.17	1.65	74	0.1	1.55	73	-0.7	117	0.111	99	103	20.9	-0.5	233	94	106	132	133	140	1190	468	88	62	86	59	74	0.064	13.26	0.47
80	10.770	13.308	0.13	0.17	1.64	74	-0.15	1.56	73	-0.7	118	0.110	100	103	20.3	-0.6	239	94	107	132	136	142	1215	474	88	62	86	60	74	0.065	13.25	0.51
82	11.037	13.644	0.13	0.17	1.64	75	0.07	1.55	73	-0.6	118	0.111	99	102	19.8	-0.5	246	95	107	132	138	144	1228	478	88	62	86	60	75	0.065	13.4	0.68
84	11.305	13.980	0.13	0.17	1.63	75	-0.22	1.54	74	-0.5	120	0.113	98	101	19.3	-0.54	253	95	107	133	140	146	1162	480	88	63	86	60	74	0.065	13.38	0.56
86	11.575	14.316	0.14	0.17	1.67	75	-0.01	1.60	74	-0.8	120	0.108	101	104	18.7	-0.56	260	96	108	134	141	148	1153	480	87	63	86	61	75	0.066	13.35	0.55
88	11.845	14.654	0.14	0.17	1.66	75	-0.24	1.59	74	-0.5	120	0.107	102	105	18.2	-0.5	266	96	108	136	142	150	1170	481	87	63	86	61	75	0.066	13.37	0.5
90	12.116	14.991	0.14	0.17	1.65	76	-0.14	1.44	74	-0.6	120	0.108	101	104	17.7	-0.54	273	97	108	138	143	152	1202	485	87	64	86	62	75	0.066	13.5	0.43
92	12.382	15.329	0.13	0.17	1.63	76	-0.08	1.42	74	-0.8	121	0.109	99	104	17.1	-0.56	279	97	109	140	144	154	1219	488	87	64	87	62	76	0.067	13.54	0.41
94	12.653	15.665	0.14	0.17	1.63	76	-0.08	1.66	75	-0.5	122	0.109	101	103	16.6	-0.5	284	98	110	142	146	156	1229	491	87	64	87	62	76	0.067	13.49	0.44
96	12.919	16.005	0.13	0.17	1.67	76	-0.42	1.60	75	-1.6	123	0.111	98	104	16.0	-0.56	290	98	111	145	147	158	1219	492	87	64	87	62	76	0.066	13.47	0.42
98	13.200	16.344	0.14	0.17	1.67	77	-0.33	1.74	75	-1.2	123	0.108	105	105	15.5	-0.5	295	99	112	147	148	160	1207	493	88	65	87	63	76	0.066	13.48	0.38
100	13.484	16.684	0.14	0.17	1.67	77	-0.46	1.63	75	-1.3	123	0.108	106	105	15.1	-0.46	300	99	113	150	150	162	1190	494	88	65	87	63	76	0.066	13.47	0.35
102	13.772	17.022	0.14	0.17	1.66	77	-0.2	1.61	76	-1.2	123	0.110	107	103	14.6	-0.48	303	100	114	153	152	164	1189	496	88	66	87	64	77	0.066	13.51	0.33
104	14.059	17.360	0.14	0.17	1.66	77	-0.23	1.63	76	-1.4	124	0.108	108	104	14.1	-0.5	306	101	115	156	154	166	1190	496	88	66	87	64	77	0.066	13.46	0.23
106	14.347	17.699	0.14	0.17	1.65	77	-0.53	1.61	76	-1.1	124	0.108	108	105	13.6	-0.5	309	101	116	158	156	168	1182	496	88	66	88	64	77	0.066	13.4	0.21
108	14.633	18.036	0.14	0.17	1.64	78	-0.5	1.60	76	-1.1	124	0.113	105	102	13.1	-0.5	313	102	118	161	159	171	1166	496	88	67	88	65	77	0.066	13.35	0.18
110	14.919	18.374	0.14	0.17	1.64	78	-0.47	1.61	77	-1.4	124	0.107	108	105	12.7	-0.42	315	103	119	163	161	172	1165	498	88	67	88	65	77	0.065	13.3	0.18
112	15.209	18.711	0.15	0.17	1.65	78	-0.58	1.65	77	-1.2	124	0.107	109	104	12.2	-0.48	317	104	121	166	163	174	1169	499	88	67	88	65	78	0.066	13.24	0.12
114	15.500	19.049	0.15	0.17	1.69	78	-0.64	1.66	77	-1.3	124	0.108	109	104	11.7	-0.46	319	104	122	168	165	176	1146	500	88	68	88	66	77	0.065	12.79	0.06
116	15.780	19.391	0.14	0.17	1.68	79	-0.57	1.59	77	-1.2	125	0.106	106	106	11.3	-0.44	320	105	124	171	167	177	1128	500	88	68	88	66	77	0.065	12.59	0.06
118	16.071	19.733	0.15	0.17	1.68	79	-0.68	1.64	77	-1	124	0.118	104	101	10.9	-0.4	322	106	125	174	169	179	1104	499	88	68	89	66	78	0.065	12.1	0.04
120	16.361	20.075	0.15	0.17	1.68	79	-0.65	1.64	78	-1.2	124	0.121	102	99	10.5	-0.4	323	107	127	176	170	181	1067	495	88	69	89	67	77	0.064	11.58	0.02
122	16.646	20.416	0.14	0.17	1.67	79	-0.5	1.55	78	-1	124	0.121	101	99	10.1	-0.4	322	108	129	178	172	182	1033	493	88	69	89	67	78	0.064	11.2	0.01
124	16.933	20.758	0.14	0.17	1.68	79	-0.71	1.61	78	-1.2	122	0.122	101	99	9.8	-0.3	321	108	130	180	174	183	1012	489	88	69	89	67	78	0.063	11.12	0.01
126	17.222	21.100	0.14	0.17	1.67	80	-0.42	1.63	78	-1.3	123	0.124	100	98	9.4	-0.4	320	109	132	181	176	184	999	486	88	69	88	67	79	0.064	11.02	0
128	17.511	21.442	0.14	0.17	1.67	80	-0.53	1.64	78	-1.2	123	0.122	101	99	9.1	-0.3	318	110	133	183	177	184	991	486	88	69	87	67	79	0.064	10.98	0
130	17.800	21.783	0.14	0.17	1.67	80	-0.71	1.62	79	-1.2	123	0.123	101	98	8.7	-0.4	316	111	135	185	179	185	988	486	88	69	87	67	79	0.064	10.91	0
132	18.088	22.124	0.14	0.17	1.67	80	-0.73	1.63	79	-1	122	0.124	100	97	8.3	-0.36	315	111	136	186	180	186	985	485	88	68	87	67	79	0.064	10.99	0
134	18.376	22.465	0.14	0.17	1.67	80	-0.81	1.62	79	-1.2	122	0.125	100	97	8.0	-0.34	313	112	137	188	182	186	992	484	88	68	87	68	79	0.063	11.1	0
136	18.664	22.806	0.14	0.17	1.67	81	-0.52	1.62	79	-1.2	123	0.122	101	98	7.7	-0.32	312	113	138	189	183	187	1005	485	88	68	87	68	79	0.064	11.24	0.01
138	18.951	23.148	0.14	0.17	1.67	81	-0.55	1.63	79	-1.2	123	0.121	101	99	7.3	-0.36	311	113	139	190	184	187	1021	487	88	68	87	68	78	0.064	11.41	0.01
140	19.239	23.489	0.14	0.17	1.67	81	-0.57	1.63	79	-1	122	0.124	100	97	7.0	-0.32	310	114	140	191	185	188	1025	490	88	69	87	68	78	0.064	11.4	0.01
142	19.526	23.830	0.14	0.17	1.67	81	-0.86	1.62	80	-1.2	123	0.121	101	99	6.7	-0.3	309	114	140	192	186	188	1017	487	88	69	87	68	78	0.062	11.28	0.01
144	19.813	24.171	0.14	0.17	1.68	81	-0.85	1.62	80	-0.9	123	0.123	100	98	6.3	-0.4	309	114	141	194	188	189	1019	489	88	69	87	68	78	0.062	11.23	0.01
146	20.101	24.513	0.14	0.17	1.68	81	-0.88	1.63	80	-1	122	0.122	101	98	6.0	-0.3	309	115	142	195	189	190	1017	489	88	69	87	68	79	0.062	11.23	0.01

Wood Heater Test Data

Run: 1

Manufacturer: New Buck Stoves
Model: 91
Tracking No.: 2372
Project No.: 0567WS001N
Test Date: 28-May-19
Beginning Clock Time: 10:26

Total Sampling Time: 172 min
Recording Interval: 2 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.009 (1) 0.996 (2) _____ (Amb)

Barometric Pressure:	Begin	Middle	End	Average
	29.46	29.46	29.46	29.46

0

OMNI Equipment Numbers: _____

PM Control Modules: 371, 372
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.270 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 21.89 ft/sec.
Initial Tunnel Flow: 237.3 scfm
Average Tunnel Flow: 229.1 scfm
Post-Test Leak Check (1): 0.000 cfm @ 8 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 10 in. Hg
Average Test Piece Fuel Moisture: 21.25 Dry Basis %

Technician Signature: _____

Velocity Traverse Data	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.078	0.104	0.112	0.096	0.076	0.106	0.112	0.102	0.114	"H2O
Temp:	68	68	68	68	68	68	68	68	68	°F

V_{strav} 20.89 ft/sec V_{scent} 22.56 ft/sec F_p 0.926

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)													Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface	Catalyst Exit	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
148	20.391	24.854	0.15	0.17	1.68	82	-0.58	1.64	80	-1.1	123	0.124	100	97	5.7	-0.3	309	115	143	197	190	191	1008	491	88	69	87	69	78	0.062	11.06	0
150	20.680	25.196	0.14	0.17	1.67	82	-0.63	1.64	80	-1.2	123	0.125	100	97	5.4	-0.3	310	116	144	198	191	192	996	491	88	69	87	69	79	0.062	10.91	0
152	20.969	25.538	0.14	0.17	1.67	82	-0.58	1.65	80	-0.9	123	0.126	99	97	5.0	-0.38	310	116	145	200	192	193	992	491	88	69	87	69	79	0.062	10.71	0.01
154	21.259	25.879	0.15	0.17	1.68	82	-0.83	1.66	81	-1.2	122	0.127	99	96	4.7	-0.32	310	117	146	201	193	193	984	490	88	69	87	69	79	0.063	10.36	0.01
156	21.548	26.221	0.14	0.17	1.68	82	-0.58	1.66	81	-0.9	122	0.124	100	97	4.5	-0.2	310	118	147	203	193	194	960	490	87	69	87	69	79	0.063	10	0
158	21.839	26.563	0.15	0.17	1.68	82	-0.62	1.66	81	-1.1	123	0.126	100	97	4.3	-0.2	310	118	148	205	194	195	940	487	88	70	87	69	79	0.063	9.81	0
160	22.130	26.905	0.15	0.17	1.67	82	-0.74	1.66	81	-1.2	122	0.122	102	98	4.0	-0.3	310	119	149	206	194	196	926	485	88	70	87	69	79	0.063	9.64	0
162	22.415	27.247	0.14	0.17	1.68	83	-0.61	1.60	81	-0.9	121	0.125	98	97	3.8	-0.24	309	119	149	207	193	195	909	483	88	70	87	70	79	0.062	9.28	0
164	22.700	27.590	0.14	0.17	1.68	83	-0.89	1.61	81	-1.1	121	0.120	100	99	3.5	-0.24	307	119	149	208	191	195	890	480	88	70	87	70	79	0.060	9.03	0
166	22.985	27.933	0.14	0.17	1.69	83	-0.6	1.60	81	-1.1	121	0.120	100	99	3.3	-0.22	305	118	149	208	189	194	875	477	88	70	87	70	78	0.060	8.85	0
168	23.270	28.277	0.14	0.17	1.69	83	-0.66	1.62	81	-0.9	120	0.125	98	97	3.1	-0.2	303	118	149	208	188	193	862	473	88	70	87	70	78	0.059	8.64	0
170	23.556	28.621	0.14	0.17	1.69	83	-0.64	1.63	81	-1.1	120	0.122	99	99	2.9	-0.2	300	118	149	208	187	192	851	471	88	70	87	70	78	0.059	8.41	0
172	23.842	28.965	0.14	0.17	1.69	83	-0.73	1.63	82	-0.8	119	0.124	99	98	2.7	-0.2	298	119	150	208	187	192	844	468	88	70	87	71	78	0.060	8.2	0
Avg/Tot	23.842	28.965	0.14	0.17	1.65	75		1.60	74		113	0.115	100	100								129.4				62	86	60	74	0.057		

Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer:	New Buck Stoves	Equipment Numbers:	
Model:	91		
Tracking No.:	2372		
Project No.:	0567WS001N		
Run #:	1		
Date:	5/28/19		

TRAIN 1 (First Hour emissions)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	T146S	83.2	78.8	4.4
C. Rear filter catch	Filter				0.0
D. Probe catch*	Probe				0.0
E. Filter seals catch*	Seals				0.0

Sub-Total Total Particulate, mg: 4.4

TRAIN 1 (Post First Hour Change-out)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	T141AP	167.1	164.4	2.7
C. Rear filter catch	Filter				0.0
D. Probe catch*	Probe	23	114077.9	114076.1	1.8
E. Filter seals catch*	Seals	R797	3404.0	3401.0	3.0

Sub-Total Total Particulate, mg: 7.5

Train 1 Aggregate Total Particulate, mg: **11.9**

TRAIN 2

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	T141BP	170.1	163.9	6.2
B. Rear filter catch	Filter	T147S	84.2	79.3	4.9
C. Probe catch*	Probe	25	114300.6	114299.0	1.6
D. Filter seals catch*	Seals	R798	3290.4	3289.5	0.9

Total Particulate, mg: **13.6**

AMBIENT

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch*	Filter				0.0

Total Particulate, mg: **0.0**

*Particulate catch that results in a negative number, is assumed to be zero for probes and seals, negative numbers for filters are assumed to be part of the seal weight.

Component	Equations:
A. Front filter catch	Final (mg) - Tare (mg) = Particulate, mg
B. Rear filter catch	Final (mg) - Tare (mg) = Particulate, mg
C. Probe catch	Final (mg) - Tare (mg) = Particulate, mg

Technician Signature: 

Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: New Buck Stoves
Model: 91
Project No.: 0567WS001N
Tracking No.: 2372
Run: 1
Test Date: 05/28/19

Burn Rate	**2.84 kg/hr dry**
Average Tunnel Temperature	113 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	21.89 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	13746.2 dscf/hour
Average Delta p	0.115 inches H20
Total Time of Test	172 minutes

	AMBIENT	SAMPLE TRAIN 1	SAMPLE TRAIN 2	FIRST HOUR FILTER (TRAIN 1)
Total Sample Volume - Vm	0.000 cubic feet	23.842 cubic feet	28.965 cubic feet	8.084 cubic feet
Average Gas Meter Temperature	74 degrees Fahrenheit	75 degrees Fahrenheit	74 degrees Fahrenheit	72 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	0.000 dscf	23.460 dscf	28.192 dscf	7.994 dscf
Total Particulates - m_n	0 mg	11.9 mg	13.6 mg	4.4 mg
Particulate Concentration (dry-standard) - C_r/C_s	0.000000 grams/dscf	0.00051 grams/dscf	0.00048 grams/dscf	0.00055 grams/dscf
Total Particulate Emissions - E_T	0.00 grams	19.99 grams	19.01 grams	7.57 grams
Particulate Emission Rate	0.00 grams/hour	6.97 grams/hour	6.63 grams/hour	7.57 grams/hour
Emissions Factor		2.46 g/kg	2.33 g/kg	-1.59 g/kg
Difference from Average Total Particulate Emissions		0.49 grams	0.49 grams	
	Dual Train Comparison Results Are Acceptable			

FINAL AVERAGE RESULTS

Complete Test Run	
Total Particulate Emissions - E_T	19.50 grams
Particulate Emission Rate	**6.80 grams/hour**
Emissions Factor	2.39 grams/kg
First Hour Emissions	
Total Particulate Emissions - E_T	7.57 grams
Particulate Emission Rate	7.57 grams/hour
Emissions Factor	-1.59 grams/kg
7.5% of Average Total Particulate Emissions	1.46 grams

QUALITY CHECKS

Filter Temps < 90 °F	OK
Filter Face Velocity (47 mm)	OK
Dryer Exit Temp < 80F	OK
Leakage Rate	OK
Ambient Temp (55-90°F)	OK
Negative Probe Weight Eval.	OK
Pro-Rate Variation	OK

Technician Signature: 

Wood Heater Efficiency Results - CSA B415.1

Manufacturer: New Buck Stoves
Technician Signature: 

Model: 91
Date: 05/28/19
Run: 1
Control #: 0567WS001N
Test Duration: 172
Output Category: III

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	82.6%	88.4%
Combustion Efficiency	98.1%	98.1%
Heat Transfer Efficiency	84%	90.1%

Output Rate (kJ/h)			**(Btu/h)**
Burn Rate (kg/h)			**(lb/h)**
Input (kJ/h)			**(Btu/h)**

Test Load Weight (dry kg)			**dry lb**
MC wet (%)	17.5235058		
MC dry (%)	21.25		
Particulate (g)	6.80		
CO (g)	110		
Test Duration (h)	2.87		

Emissions	Particulate	CO
g/MJ Output	0.09	1.48
g/kg Dry Fuel	1.50	24.35
g/h	2.37	38.45
lb/MM Btu Output	0.21	3.43

Air/Fuel Ratio (A/F)	10.77

VERSION: **2.2** **12/14/2009**

Adjunct to ASTM E XXXX Wood Heater Cordwood Test Method - May 10, 2017 Version

Cordwood Fuel Load Calculators - 10 lb/ft^3 Nominal Load Density

Core 45-65% of Total Load Weight, Remainder 35-55% of Total Load Weight

Values to be input manually

For All Usable Firebox Volumes - High Fire Test Only

Nominal Required Load Density (wet basis)	10	lb/ft^3				
Usable Firebox Volume	2.61	ft^3				
Total Nom. Load Wt. Target	26.10	lb				
Total Load Wt. Allowable Range	24.80	to	27.40	lb		
Core Target Wt. Allowable Range	11.70	to	17.00	lb		
Remainder Load Wt. Allowable Range	9.10	to	14.40	lb		
						Mid-Point
Core Load Pc. Wt. Allowable Range	3.90	to	6.50	lb		5.20
Remainder Load Pc. Wt. Allowable Range	2.60	to	14.40	lb		8.50
	Pc. #					
Core Load Piece Wt. Actual	1	5.80	lb	In Range		
	2	4.90	lb	In Range		
	3	4.40	lb	In Range		
Core Load Total. Wt. Actual		15.10	lb	In Range		
	Pc. #					
Remainder Load Piece Wt.	1	6.20	lb	In Range		
(1 to 3 Pcs.)	2	3.70	lb	In Range		
	3		lb	NA		
Remainder Load Tot. Wt. Act		9.90	lb	In Range		
Total Load Wt. Actual		25.00	lb	In Range		
Core % of Total Wt.		60%		In Range	45-65%	
Remainder % of Total Wt.		40%		In Range	35-55%	
Actual Load % of Nominal Target		96%		In Range	95-105%	
Actual Fuel Load Density		9.6	lb/ft^3			
Kindling and Start-up Fuel						
Maximim Kindling Wt. (20% of Tot. Load Wt.)		5.00	lb			
Actual Kindling Wt.		4.80	lb	In Range	19.2%	
Maximum Start-up Fuel Wt. (30% of Tot. Load Wt.)		7.50	lb			
Actual Start-up Fuel Wt.		7.30	lb	In Range	29.2%	
Allowable Residual Start-up Fuel Wt. Range	2.5	to	5.0	lb		Mid-Point
Actual Residual Start-up Fuel Wt.		2.5	lb	In Range		3.8
Total Wt. All Fuel Added (wet basis)		37.10	lb			
High Fire Test Run End Point Range	Low		High			Mid-Point
Based on Fuel Load Wt. (w/tares)	2.3	to	2.8	lb		2.5
Actual Fuel Load Ending Wt.		2.7	lb	In Range		

Fuel Piece Moisture Reading (%-dry basis)

1	2	3	Ave.		Pc. Wt. Dry Basis	
19.2	19.4	22.9	20.5	In Range	4.81 lb	2.18 kg
20.9	27.9	19.2	22.7	In Range	3.99 lb	1.81 kg
20.5	27.7	18	22.1	In Range	3.60 lb	1.64 kg
18	20.5	19.6	19.4	In Range	5.19 lb	2.36 kg
20.3	19.9	24.7	21.6	In Range	3.04 lb	1.38 kg
			NA	NA	NA lb	NA kg

Total Load Ave. MC (%-dry basis)	21.1	In Range	
Total Load Ave. MC % (wet basis)	17.4		
Total Test Load Weight (dry basis) →			20.65 lb 9.37 kg

Kindling Moisture (%-dry basis)

11.9	12	11.9	11.9	In Range	4.29 lb	1.95 kg

Start-up Fuel Moisture Readings (%-dry basis)

22.4	20.9	20	21.1	In Range	6.03 lb	2.73 kg

Total Wt. All Fuel Added (dry basis) →	30.96 lb	14.05 kg
Total Wt. All Fuel Burned (dry basis) →	25.8 lb	11.7 kg

OMNI-Test Laboratories, Inc.

Wood Heater Run Sheets

Client: New Buck Corp. Project Number: 0567WS001N Run Number: 1
Model: 91 Tracking Number: 2372 Date: 5/27/17
Test Crew: B Davis
OMNI Equipment ID numbers: 132, 650, 283A, 371, 372, 410, 559, 592, 594, 637, 16-1407029

Wood Heater Run Notes

Air Control Settings

Primary:

Fully open

Secondary: Fixed

Tertiary/Pilot: N/A

Fan: On High

Preburn Notes

2:00 min.

Time	Notes
58	High burn start Torch for 40 sec. bypass open until 3:00 door open until 2:00 Primary Air fully open. Shotgun Air open until 3:00 then closed FAN turned on Automatic @ 38 min Leveled coal bed and added 2.5 maple wood.

Test Notes

Sketch test fuel configuration:

See photo

Start up procedures & Timeline:

Bypass: Closed by 1:00
Fuel loaded by: ~~Less than~~ 1:00
Door closed at: 1:00
Primary air: fully open entire test

Notes: Boost Air not used
FAN on High entire test

Time	Notes
60	Changed front filter in Train A
62	Changed front filter in Train B

Technician Signature: B Davis Date: 8/5/17

OMNI-Test Laboratories, Inc.

Wood Heater Run Sheets

Client: New Buck Corp. Project Number: 0567WS001N Run Number: 1
Model: 91 Tracking Number: 2372 Date: 5/22/19
Test Crew: D Dams
OMNI Equipment ID numbers: 132, 650, 283A, 371, 372, 410, 559, 592, 594, 637, 16-140TT029

Wood Heater Supplemental Data

Start Time: 10:26
Stop Time: 13:38

Booth #: N/A

Stack Gas Leak Check:
Initial: good Final: good

Sample Train Leak Check:
A: 0.0 @ 8 "Hg
B: 0.0 @ 10 "Hg

Calibrations: Span Gas CO_2: 10.08 CO: 2.53

	Pre Test		Post Test	
	Zero	Span	Zero	Span
Time	10:21	10:21	See run 2	
CO_2	0.00	10.08		
CO	0.000	2.509		

Air Velocity (ft/min): Initial: <50 Final: <50
Scale Audit (lbs): Initial: 10.0 Final: 10.0
Pitot Tube Leak Test: Initial: good Final: good
Stack Diameter (in): 8"
Induced Draft: 0.0
% Smoke Capture: 100%
Flue Pipe Cleaned Prior to First Test in Series:
Date: 5/22/19 Initials: DL

	Initial	Middle	Ending
P_b (in/Hg)	29.46		29.46
RH (%)	61%		47
Ambient (°F)	66		78

Tunnel Traverse

Microtector Reading	dP (in H_2O)	T(°F)
	.078	68
	.104	68
	.112	68
	.096	68
	.076	68
	.106	68
	.112	68
	.102	68
Center:		
	.114	68

Tunnel Static Pressure (in H_2O):	
Beginning of Test	End of Test
-.27	-.27

Background Filter Volume: N/A

Technician Signature: [signature] Date: 5/5/19

Run 1

High Burn 2-minute data

Efficiency and Heat Output Results
Kindling and start-up fuel removed from calculations

Wood Heater Test Data

Run: 1

Manufacturer: New Buck Stoves
Model: 91
Tracking No.: 2372
Project No.: 0567WS001N
Test Date: 28-May-19
Beginning Clock Time: 10:26

Total Sampling Time: 112 min
Recording Interval: 2 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.009 (1) 0.996 (2) _____ (Amb)

Barometric Pressure:	Begin	Middle	End	Average
	29.46		29.46	29.46 0

OMNI Equipment Numbers: _____

PM Control Modules: _____
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.270 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: #DIV/0! ft/sec.
Initial Tunnel Flow: #DIV/0! scfm
Average Tunnel Flow: #DIV/0! scfm
Post-Test Leak Check (1): _____ cfm @ _____ in. Hg
Post-Test Leak Check (2): _____ cfm @ _____ in. Hg
Average Test Piece Fuel Moisture: 21.25 Dry Basis %

Technician Signature: _____

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP										"H2O
Temp:										°F

V_{strav} _____ ft/sec V_{scent} _____ ft/sec F_p _____

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)													Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface	Catalyst Exit	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
0															22.3		228	86	112	145	133	141	673	393					72	0.052	4.6	0.1
2															21.8		228	88	111	145	132	141	670	408					72	0.057	5.1	0.03
4															21.5		227	89	110	144	131	140	695	411					73	0.057	5.13	0.03
6															21.3		226	90	109	142	130	139	700	410					73	0.057	5.37	0.03
8															20.9		224	91	108	139	129	138	688	405					73	0.056	5.17	0.03
10															20.4		223	91	107	137	128	137	856	414					73	0.058	5.19	0.03
12															19.8		222	92	107	135	129	137	1077	439					73	0.061	5.82	0.27
14															19.2		224	93	106	133	129	137	1172	453					74	0.063	12.55	0.4
16															18.7		228	93	106	132	131	138	1177	462					74	0.064	13.08	0.47
18															18.2		233	94	106	132	133	140	1190	468					74	0.064	13.26	0.47
20															17.6		239	94	107	132	136	142	1215	474					74	0.065	13.25	0.51
22															17.1		246	95	107	132	138	144	1228	478					75	0.065	13.4	0.68
24															16.6		253	95	107	133	140	146	1162	480					74	0.065	13.38	0.56
26															16.0		260	96	108	134	141	148	1153	480					75	0.066	13.35	0.55
28															15.5		266	96	108	136	142	150	1170	481					75	0.066	13.37	0.5
30															15.0		273	97	108	138	143	152	1202	485					75	0.066	13.5	0.43
32															14.4		279	97	109	140	144	154	1219	488					76	0.067	13.54	0.41
34															13.9		284	98	110	142	146	156	1229	491					76	0.067	13.49	0.44
36															13.3		290	98	111	145	147	158	1219	492					76	0.066	13.47	0.42
38															12.8		295	99	112	147	148	160	1207	493					76	0.066	13.48	0.38
40															12.4		300	99	113	150	150	162	1190	494					76	0.066	13.47	0.35
42															11.9		303	100	114	153	152	164	1189	496					77	0.066	13.51	0.33
44															11.4		306	101	115	156	154	166	1190	496					77	0.066	13.46	0.23
46															10.9		309	101	116	158	156	168	1182	496					77	0.066	13.4	0.21
48															10.4		313	102	118	161	159	171	1166	496					77	0.066	13.35	0.18
50															10.0		315	103	119	163	161	172	1165	498					77	0.065	13.3	0.18
52															9.5		317	104	121	166	163	174	1169	499					78	0.066	13.24	0.12
54															9.0		319	104	122	168	165	176	1146	500					77	0.065	12.79	0.06
56															8.6		320	105	124	171	167	177	1128	500					77	0.065	12.59	0.06
58															8.2		322	106	125	174	169	179	1104	499					78	0.065	12.1	0.04
60															7.8		323	107	127	176	170	181	1067	495					77	0.064	11.58	0.02
62															7.4		322	108	129	178	172	182	1033	493					78	0.064	11.2	0.01
64															7.1		321	108	130	180	174	183	1012	489					78	0.063	11.12	0.01
66															6.7		320	109	132	181	176	184	999	486					79	0.064	11.02	0
68															6.4		318	110	133	183	177	184	991	486					79	0.064	10.98	0
70															6.0		316	111	135	185	179	185	988	486					79	0.064	10.91	0
72															5.6		315	111	136	186	180	186	985	485					79	0.064	10.99	0

Wood Heater Test Data

Run: 1

Manufacturer: New Buck Stoves
Model: 91
Tracking No.: 2372
Project No.: 0567WS001N
Test Date: 28-May-19
Beginning Clock Time: 10:26

Total Sampling Time: 112 min
Recording Interval: 2 min
Background Sample Volume: ____ cubic feet

Meter Box Y Factor: 1.009 (1) 0.996 (2) ____ (Amb)

Barometric Pressure:	Begin	Middle	End	Average
	29.46		29.46	29.46 0

OMNI Equipment Numbers: ____

PM Control Modules: ____
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.270 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: #DIV/0! ft/sec.
Initial Tunnel Flow: #DIV/0! scfm
Average Tunnel Flow: #DIV/0! scfm
Post-Test Leak Check (1): ____ cfm @ ____ in. Hg
Post-Test Leak Check (2): ____ cfm @ ____ in. Hg
Average Test Piece Fuel Moisture: 21.25 Dry Basis %

Technician Signature: ____

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP										"H2O
Temp:										°F

V_{strav} ____ ft/sec V_{scent} ____ ft/sec F_p ____

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)												Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface	Catalyst Exit	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
74															5.3		313	112	137	188	182	186	992	484					79	0.063	11.1	0
76															5.0		312	113	138	189	183	187	1005	485					79	0.064	11.24	0.01
78															4.6		311	113	139	190	184	187	1021	487					78	0.064	11.41	0.01
80															4.3		310	114	140	191	185	188	1025	490					78	0.064	11.4	0.01
82															4.0		309	114	140	192	186	188	1017	487					78	0.062	11.28	0.01
84															3.6		309	114	141	194	188	189	1019	489					78	0.062	11.23	0.01
86															3.3		309	115	142	195	189	190	1017	489					79	0.062	11.23	0.01
88															3.0		309	115	143	197	190	191	1008	491					78	0.062	11.06	0
90															2.7		310	116	144	198	191	192	996	491					79	0.062	10.91	0
92															2.3		310	116	145	200	192	193	992	491					79	0.062	10.71	0.01
94															2.0		310	117	146	201	193	193	984	490					79	0.063	10.36	0.01
96															1.8		310	118	147	203	193	194	960	490					79	0.063	10	0
98															1.6		310	118	148	205	194	195	940	487					79	0.063	9.81	0
100															1.3		310	119	149	206	194	196	926	485					79	0.063	9.64	0
102															1.1		309	119	149	207	193	195	909	483					79	0.062	9.28	0
104															0.8		307	119	149	208	191	195	890	480					79	0.060	9.03	0
106															0.6		305	118	149	208	189	194	875	477					78	0.060	8.85	0
108															0.4		303	118	149	208	188	193	862	473					78	0.059	8.64	0
110															0.2		300	118	149	208	187	192	851	471					78	0.059	8.41	0
112															0.0		298	119	150	208	187	192	844	468					78	0.060	8.2	0
Avg/Tot	0.000	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!								51.6				#DIV/0!	#DIV/0!	#DIV/0!	77	0.063		

Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: New Buck Stoves
Model: 91
Project No.: 0567WS001N
Tracking No.: 2372
Run: 1
Test Date: 05/28/19

Burn Rate	**4.36 kg/hr dry**
Average Tunnel Temperature	
Average Gas Velocity in Dilution Tunnel - vs	
Average Gas Flow Rate in Dilution Tunnel - Qsd	
Average Delta p	
Total Time of Test	112 minutes

	AMBIENT	SAMPLE TRAIN 1	SAMPLE TRAIN 2	FIRST HOUR FILTER (TRAIN 1)
	#DIV/0!			

FINAL AVERAGE RESULTS

QUALITY CHECKS

Technician Signature: _____

Wood Heater Efficiency Results - CSA B415.1

Manufacturer: New Buck Stoves
Model: 91
Date: 05/28/19
Run: 1
Control #: 0567WS001N
Test Duration: 112
Output Category: IV

Technician Signature:

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	74.1%	79.3%
Combustion Efficiency	98.9%	98.9%
Heat Transfer Efficiency	75%	80.1%

Output Rate (kJ/h)	66,144	62,745	**(Btu/h)**
Burn Rate (kg/h)	4.47	9.85	**(lb/h)**
Input (kJ/h)	89,231	84,646	**(Btu/h)**

Test Load Weight (dry kg)	8.34	18.39	**dry lb**
MC wet (%)	17.5235058		
MC dry (%)	21.25		
Particulate (g)	N/A		
CO (g)	153		
Test Duration (h)	1.87		

Emissions	**Particulate**	**CO**
g/MJ Output	#DIV/0!	N/A
g/kg Dry Fuel	#DIV/0!	N/A
g/h	#DIV/0!	N/A
lb/MM Btu Output	#DIV/0!	N/A

Air/Fuel Ratio (A/F)	10.21

VERSION: **2.2** **12/14/2009**

OMNI-Test Laboratories, Inc.

Wood Heater Run Sheets

Client: New Buck Corp. Project Number: 0567WS001N Run Number: 1
Model: 91 Tracking Number: 2372 Date: 5/27/17
Test Crew: B Davis
OMNI Equipment ID numbers: ~~132~~, 650, 283A, 371, ~~372~~, 410, 559, 592, 594, ~~637~~, 16-1407029

Wood Heater Run Notes

Air Control Settings

Primary:

Fully open

Secondary: Fixed

Tertiary/Pilot: N/A

Fan: On High

Preburn Notes

2:00 min.

Time	Notes
58	High burn start Timer for 40 sec. bypass open until 3:00 door open until ~~2:~~ Primary Air fully open. Shotgun Air open until 3:00 then closed FAN turned on Automatic @ 38 min Leveled coal bed and added 2.5 maple wood.

Test Notes

Sketch test fuel configuration:

See photo

Start up procedures & Timeline:

Bypass: Closed by 1:00
Fuel loaded by: ~~Bypass~~ 1:00
Door closed at: 1:00
Primary air: fully open entire test

Notes: Boost Air not used
FAN on High entire test

Time	Notes
60	Changed front filter in Train A
62	Changed front filter in Train B

Technician Signature: B Davis Date: 8/5/17

OMNI-Test Laboratories, Inc.

Wood Heater Run Sheets

Client: New Buck Corp. Project Number: 0567WS001N Run Number: 1
Model: 91 Tracking Number: 2372 Date: 5/23/19
Test Crew: D Dams
OMNI Equipment ID numbers: 132, 650, 283A, 371, 372, 410, 559, 592, 594, 637, 16-140TT029

Wood Heater Supplemental Data

Start Time: 10:26
Stop Time: 13:38

Booth #: N/A

Stack Gas Leak Check:
Initial: good Final: good

Sample Train Leak Check:
A: 0.0 @ 8 "Hg
B: 0.0 @ 10 "Hg

Calibrations: Span Gas CO_2: 10.08 CO: 2.53

	Pre Test		Post Test	
	Zero	Span	Zero	Span
Time	10:21	10:21	See run 2	
CO_2	0.00	10.08		
CO	0.000	2.509		

Air Velocity (ft/min): Initial: <50 Final: <50
Scale Audit (lbs): Initial: 10.0 Final: 10.0
Pitot Tube Leak Test: Initial: good Final: good
Stack Diameter (in): 8"
Induced Draft: 0.0
% Smoke Capture: 100%
Flue Pipe Cleaned Prior to First Test in Series:
Date: 5/22/19 Initials: DL

	Initial	Middle	Ending
P_b (in/Hg)	29.46		29.46
RH (%)	61%		47
Ambient (°F)	66		78

Tunnel Traverse

Microtector Reading	dP (in H_2O)	T(°F)
	.078	68
	.104	68
	.112	68
	.096	68
	.076	68
	.106	68
	.112	68
	.102	68
Center:		
	.114	68

Tunnel Static Pressure (in H_2O):	
Beginning of Test	End of Test
-.27	-.27

Background Filter Volume: N/A

Technician Signature: [signature] Date: 8/5/19

Run 2

Medium Burn

Wood Heater Test Data

Run: 2

Manufacturer: New Buck Stoves
Model: 91
Tracking No.: 2372
Project No.: 0567WS001N
Test Date: 28-May-19
Beginning Clock Time: 13:41

Total Sampling Time: 1230 min
Recording Interval: 10 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.009 (1) 0.996 (2) _____ (Amb)

Barometric Pressure:	Begin	Middle	End	Average
	29.45		29.39	29.42

0

OMNI Equipment Numbers: _____

PM Control Modules: 371, 372
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.230 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 18.91 ft/sec.
Initial Tunnel Flow: 211.0 scfm
Average Tunnel Flow: 210.8 scfm
Post-Test Leak Check (1): 0.000 cfm @ 12 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 8 in. Hg
Average Test Piece Fuel Moisture: 20.97 Dry Basis %

Technician Signature: _____

Velocity Traverse Data	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.064	0.086	0.090	0.084	0.060	0.086	0.090	0.080	0.091	"H2O
Temp:	84	83	83	83	83	83	83	83	83	°F

V_{strav} 19.12 ft/sec V_{scent} 20.44 ft/sec F_p 0.935

	Particulate Sampling Data													Fuel Weight (lb)		Temperature Data (°F)													Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface	Catalyst Exit	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
0	0.000	0.000			2.25	83	-0.78	1.76	81	-0.6	123	0.090			29.6		281	128	149	200	180	188	785	462	81	72	80	72	78	0.060	4.27	0
10	1.614	1.747	0.16	0.17	2.19	83	-1.11	1.77	82	-0.5	128	0.080	109	109	26.5	-3.1	296	134	151	204	175	192	1220	504	88	68	86	68	78	0.066	14.7	1.03
20	3.235	3.511	0.16	0.18	2.21	83	-1.08	1.79	82	-0.6	93	0.090	100	101	25.6	-0.9	317	134	145	194	165	191	968	282	85	70	82	68	78	0.040	8.49	0
30	4.879	5.278	0.16	0.18	2.23	83	-1.19	1.78	82	-0.7	90	0.090	101	100	24.8	-0.8	295	133	137	177	152	179	859	249	84	72	81	70	78	0.033	8.96	0
40	6.533	7.045	0.17	0.18	2.27	83	-0.97	1.82	82	-0.7	88	0.090	101	100	24.1	-0.7	267	130	130	163	141	166	804	230	85	73	81	71	77	0.029	7.87	0
50	8.194	8.826	0.17	0.18	2.31	82	-1.04	1.81	81	-0.6	85	0.090	102	101	23.6	-0.5	242	125	123	151	133	155	744	215	84	73	80	71	77	0.025	7.28	0
60	9.859	10.605	0.17	0.18	2.23	82	-1.12	1.80	81	-0.5	84	0.090	102	101	23.1	-0.5	221	119	118	141	125	145	721	205	84	73	79	71	76	0.022	6.95	0.01
70	11.506	12.382	0.16	0.18	2.20	82	-0.97	1.81	81	-0.7	83	0.090	101	101	22.6	-0.5	204	115	113	133	120	137	698	198	83	73	91	71	76	0.020	7.28	0.01
80	13.140	14.157	0.16	0.18	2.22	82	-0.9	1.80	81	-0.5	82	0.090	100	100	22.2	-0.4	192	111	110	128	116	131	682	191	83	72	87	70	75	0.018	7.24	0.01
90	14.776	15.932	0.16	0.18	2.23	81	-0.86	1.79	80	-0.7	81	0.090	100	100	21.8	-0.4	183	108	106	123	112	126	679	187	83	72	84	70	75	0.017	7.6	0.01
100	16.412	17.703	0.16	0.18	2.22	81	-0.96	1.78	80	-0.4	80	0.090	100	100	21.3	-0.5	176	104	103	119	108	122	697	185	83	72	81	70	75	0.017	7.98	0.02
110	18.046	19.473	0.16	0.18	2.22	81	-0.93	1.79	80	-0.4	79	0.090	100	100	20.9	-0.4	171	98	98	113	103	117	712	185	83	71	81	70	74	0.016	8.41	0.02
120	19.677	21.241	0.16	0.18	2.20	80	-0.79	1.78	79	-0.5	79	0.090	100	100	20.4	-0.5	169	97	97	111	101	115	747	184	83	70	82	69	73	0.016	8.66	0.02
130	21.307	23.005	0.16	0.18	2.22	80	-0.96	1.78	79	-0.6	79	0.090	100	100	19.9	-0.5	168	98	97	111	101	115	750	184	83	70	80	69	74	0.016	8.91	0.03
140	22.935	24.769	0.16	0.18	2.20	80	-0.86	1.78	79	-0.5	80	0.090	100	100	19.4	-0.5	169	98	97	110	101	115	785	185	82	70	81	69	74	0.017	9.58	0.03
150	24.562	26.529	0.16	0.18	2.21	80	-0.91	1.78	78	-0.4	80	0.090	100	100	18.8	-0.6	171	97	97	110	100	115	800	186	81	70	83	69	75	0.016	9.52	0.03
160	26.188	28.289	0.16	0.18	2.20	80	-0.71	1.77	78	-0.6	80	0.080	106	106	18.3	-0.5	173	97	96	110	100	115	791	186	79	70	83	69	74	0.016	9.84	0.05
170	27.812	30.045	0.16	0.18	2.19	80	-0.96	1.77	78	-0.4	81	0.090	100	100	17.7	-0.6	174	97	96	110	101	116	788	185	83	70	83	69	76	0.016	9.63	0.04
180	29.433	31.801	0.16	0.18	2.18	80	-0.94	1.77	79	-0.4	82	0.090	99	100	17.2	-0.5	175	97	96	110	101	116	810	188	83	70	83	70	75	0.016	10.08	0.05
190	31.056	33.557	0.16	0.18	2.19	80	-0.8	1.77	79	-0.4	81	0.090	99	100	16.6	-0.6	177	96	96	111	101	116	842	190	83	71	83	70	76	0.017	10.3	0.06
200	32.679	35.315	0.16	0.18	2.19	80	-0.64	1.77	79	-0.6	81	0.090	99	100	16.1	-0.5	180	96	96	111	101	117	825	189	83	71	83	71	77	0.016	9.6	0.04
210	34.300	37.069	0.16	0.18	2.19	81	-0.64	1.76	79	-0.4	82	0.090	99	100	15.6	-0.5	180	96	96	111	101	117	787	188	83	71	83	71	76	0.015	9.29	0.04
220	35.928	38.830	0.16	0.18	2.20	81	-0.65	1.78	79	-0.6	82	0.090	100	100	15.1	-0.5	178	96	96	111	102	117	775	186	83	71	83	72	76	0.015	9.41	0.04
230	37.563	40.600	0.16	0.18	2.22	81	-0.92	1.79	79	-0.5	83	0.090	100	101	14.6	-0.5	176	96	96	111	102	116	766	185	83	72	84	72	77	0.014	9.33	0.04
240	39.200	42.370	0.16	0.18	2.23	81	-0.67	1.78	80	-0.6	83	0.090	100	100	14.1	-0.5	175	96	97	112	102	116	763	184	83	72	84	73	77	0.014	9.33	0.04
250	40.835	44.137	0.16	0.18	2.23	81	-0.95	1.77	80	-0.4	83	0.090	100	100	13.7	-0.4	175	96	96	112	102	116	780	183	83	73	84	73	78	0.014	9.6	0.04
260	42.471	45.901	0.16	0.18	2.23	82	-0.72	1.78	80	-0.7	83	0.090	100	100	13.2	-0.5	176	96	97	112	102	117	821	186	84	73	84	74	78	0.015	9.98	0.05
270	44.107	47.664	0.16	0.18	2.21	82	-0.82	1.77	80	-0.7	83	0.090	100	100	12.8	-0.4	178	96	97	112	102	117	823	187	84	74	84	75	78	0.014	9.72	0.04
280	45.743	49.428	0.16	0.18	2.20	82	-0.68	1.78	80	-0.5	82	0.090	100	100	12.4	-0.4	179	96	96	112	102	117	783	185	84	75	84	75	77	0.014	8.71	0.03
290	47.379	51.193	0.16	0.18	2.20	82	-0.69	1.77	80	-0.6	82	0.090	100	100	12.1	-0.3	176	95	96	112	102	116	686	179	83	75	84	76	78	0.012	7.63	0.02
300	49.014	52.954	0.16	0.18	2.20	82	-0.72	1.76	81	-0.4	81	0.090	100	99	11.8	-0.3	170	95	96	112	101	115	600	171	83	75	84	76	77	0.009	7.09	0.02
310	50.645	54.712	0.16	0.18	2.20	82	-0.94	1.76	81	-0.6	81	0.090	100	99	11.6	-0.2	162	95	96	111	101	113	551	163	83	75	83	76	77	0.007	6.99	0.02
320	52.275	56.470	0.16	0.18	2.18	82	-0.99	1.77	80	-0.4	80	0.090	99	99	11.4	-0.2	155	95	96	110	101	111	524	158	83	75	83	76	77	0.006	6.93	0.02
330	53.904	58.226	0.16	0.18	2.20	82	-0.87	1.77	80	-0.5	79	0.090	99	99	11.2	-0.2	150	95	95	110	100	110	507	155	83	75	83	77	77	0.005	6.91	0.02
340	55.533	59.981	0.16	0.18	2.20	82	-0.66	1.77	80	-0.6	79	0.090	99	99	11.0	-0.2	147	95	95	109	100	109	530	152	83	75	83	77	77	0.004	6.92	0.02
350	57.163	61.740	0.16	0.18	2.19	82	-0.76	1.77	80	-0.5	79	0.090	99	99	10.8	-0.2	144	94	95	108	99	108	525	150	83	75	83	76	76	0.003	7.08	0.02
360	58.793	63.501	0.16	0.18	2.20	82	-0.85	1.77	80	-0.6	78	0.090	99	99	10.7	-0.1	141	94	94	108	99	107	522	148	83	71	83	71	76	0.003	6.92	0.02

Wood Heater Test Data

Run: 2

Manufacturer: New Buck Stoves
Model: 91
Tracking No.: 2372
Project No.: 0567WS001N
Test Date: 28-May-19
Beginning Clock Time: 13:41

Total Sampling Time: 1230 min
Recording Interval: 10 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.009 (1) 0.996 (2) _____ (Amb)

Barometric Pressure:	Begin	Middle	End	Average
	29.45		29.39	29.42

0

OMNI Equipment Numbers: _____

PM Control Modules: 371, 372
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.230 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 18.91 ft/sec.
Initial Tunnel Flow: 211.0 scfm
Average Tunnel Flow: 210.8 scfm
Post-Test Leak Check (1): 0.000 cfm @ 12 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 8 in. Hg
Average Test Piece Fuel Moisture: 20.97 Dry Basis %

Technician Signature: _____

Velocity Traverse Data	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.064	0.086	0.090	0.084	0.060	0.086	0.090	0.080	0.091	"H2O
Temp:	84	83	83	83	83	83	83	83	83	°F

V_{strav} 19.12 ft/sec V_{scent} 20.44 ft/sec F_p 0.935

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)												Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface	Catalyst Exit	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
370	60.419	65.262	0.16	0.18	2.18	82	-0.83	1.78	80	-0.5	78	0.090	99	99	10.5	-0.2	140	94	94	107	98	107	525	148	83	68	83	67	75	0.003	7.06	0.02
380	62.046	67.022	0.16	0.18	2.17	81	-0.98	1.77	80	-0.6	77	0.090	99	99	10.3	-0.2	139	93	94	106	98	106	532	148	83	65	83	64	75	0.003	6.98	0.02
390	63.670	68.782	0.16	0.18	2.19	81	-0.98	1.77	79	-0.6	77	0.090	99	99	10.1	-0.2	138	93	93	106	97	105	535	146	83	64	83	62	74	0.002	7.26	0.02
400	65.294	70.541	0.16	0.18	2.17	81	-0.68	1.77	79	-0.5	76	0.090	99	99	9.9	-0.2	138	93	93	105	97	105	546	147	83	63	82	61	73	0.003	7.49	0.02
410	66.917	72.300	0.16	0.18	2.19	80	-0.77	1.76	79	-0.6	76	0.090	99	99	9.7	-0.2	138	92	93	105	97	105	559	147	83	62	82	60	72	0.003	7.61	0.02
420	68.544	74.073	0.16	0.18	2.21	80	-0.68	1.82	78	-0.5	75	0.090	99	100	9.5	-0.2	138	92	93	105	97	105	572	147	82	61	82	59	74	0.003	7.81	0.02
430	70.176	75.856	0.16	0.18	2.21	80	-0.88	1.82	78	-0.5	75	0.090	99	101	9.3	-0.2	139	92	93	105	97	105	577	149	82	60	82	59	72	0.003	7.77	0.02
440	71.808	77.636	0.16	0.18	2.20	79	-0.87	1.82	78	-0.4	75	0.090	100	101	9.1	-0.2	140	92	93	106	97	106	579	148	82	60	82	59	73	0.004	7.72	0.02
450	73.436	79.411	0.16	0.18	2.20	79	-0.98	1.80	77	-0.5	75	0.090	99	100	8.9	-0.2	141	92	93	106	97	106	576	150	82	59	82	59	72	0.004	7.77	0.02
460	75.065	81.184	0.16	0.18	2.21	79	-0.67	1.80	77	-0.7	75	0.090	99	100	8.7	-0.2	141	92	93	106	97	106	579	150	82	60	82	58	72	0.004	7.86	0.02
470	76.692	82.955	0.16	0.18	2.19	79	-0.94	1.80	77	-0.6	75	0.090	99	100	8.4	-0.3	142	92	93	106	97	106	589	150	82	60	82	58	71	0.004	7.79	0.03
480	78.319	84.724	0.16	0.18	2.21	78	-0.96	1.79	77	-0.6	75	0.090	100	100	8.2	-0.2	143	92	93	106	97	106	586	152	82	60	82	58	71	0.005	7.53	0.03
490	79.947	86.494	0.16	0.18	2.20	78	-1.02	1.80	76	-0.5	74	0.090	100	100	8.0	-0.2	143	91	92	106	97	106	579	151	82	60	82	58	71	0.005	7.26	0.02
500	81.572	88.261	0.16	0.18	2.19	78	-0.76	1.79	76	-0.5	74	0.090	99	100	7.6	-0.4	142	91	92	106	97	106	561	149	82	60	82	58	71	0.004	7.27	0.02
510	83.197	90.027	0.16	0.18	2.20	78	-0.67	1.79	76	-0.5	74	0.090	99	100	7.6	0	141	91	92	105	97	105	554	148	82	60	81	58	71	0.004	7.16	0.03
520	84.822	91.791	0.16	0.18	2.20	78	-1.01	1.79	76	-0.8	74	0.090	99	100	7.5	-0.1	140	91	92	105	96	105	551	147	82	60	81	58	70	0.003	7.27	0.03
530	86.446	93.558	0.16	0.18	2.20	77	-0.77	1.80	76	-0.5	73	0.090	99	100	7.3	-0.2	140	91	92	105	96	105	548	146	82	60	81	58	71	0.003	7.33	0.03
540	88.070	95.326	0.16	0.18	2.19	77	-0.89	1.79	75	-0.7	73	0.090	99	100	7.2	-0.14	139	91	92	105	96	105	547	146	82	61	81	59	71	0.003	7.27	0.03
550	89.695	97.094	0.16	0.18	2.18	77	-0.98	1.79	75	-0.7	73	0.090	99	100	6.9	-0.26	139	90	92	104	96	104	546	146	81	61	81	59	69	0.003	7.35	0.03
560	91.318	98.860	0.16	0.18	2.20	77	-0.97	1.78	75	-0.5	76	0.090	100	100	6.8	-0.1	138	91	92	104	97	104	545	145	82	61	81	59	72	0.003	7.26	0.03
570	92.939	100.623	0.16	0.18	2.18	77	-0.95	1.79	75	-0.5	79	0.090	100	100	6.5	-0.3	138	91	93	104	98	105	544	145	83	61	83	60	74	0.002	7.3	0.03
580	94.561	102.386	0.16	0.18	2.20	78	-1.02	1.79	76	-0.8	80	0.090	100	100	6.4	-0.12	138	91	93	105	98	105	549	146	83	62	83	62	75	0.002	7.51	0.03
590	96.187	104.152	0.16	0.18	2.20	78	-0.74	1.80	76	-0.5	80	0.090	100	101	6.1	-0.28	139	92	94	105	99	106	561	147	83	63	83	63	75	0.002	7.69	0.03
600	97.814	105.920	0.16	0.18	2.18	78	-0.94	1.80	77	-0.7	80	0.090	100	100	5.9	-0.2	139	92	94	105	99	106	580	148	83	64	83	65	75	0.002	7.97	0.03
610	99.443	107.689	0.16	0.18	2.21	79	-0.96	1.79	77	-0.7	81	0.090	100	101	5.6	-0.3	141	92	95	105	100	107	600	151	83	65	83	67	76	0.004	8.19	0.03
620	101.073	109.454	0.16	0.18	2.21	79	-0.81	1.78	78	-0.6	81	0.090	100	100	5.4	-0.2	143	93	95	106	100	107	608	152	83	66	83	68	76	0.004	8.19	0.03
630	102.703	111.216	0.16	0.18	2.20	80	-0.92	1.77	78	-0.7	82	0.090	100	100	5.1	-0.3	144	93	95	106	100	108	619	154	83	66	83	69	77	0.003	8.41	0.03
640	104.334	112.978	0.16	0.18	2.21	80	-0.83	1.77	79	-0.5	83	0.090	100	100	4.9	-0.2	146	93	96	107	101	109	626	155	84	67	83	70	78	0.003	8.28	0.03
650	105.968	114.740	0.16	0.18	2.24	81	-0.81	1.78	79	-0.7	84	0.090	100	100	4.6	-0.3	148	93	96	108	101	109	625	156	84	68	83	71	78	0.003	8.24	0.03
660	107.606	116.504	0.16	0.18	2.22	81	-1.04	1.76	80	-0.7	84	0.090	101	100	4.4	-0.2	149	94	97	108	102	110	610	157	83	69	83	72	79	0.003	7.99	0.03
670	109.241	118.266	0.16	0.18	2.21	82	-0.95	1.77	80	-0.5	84	0.090	100	100	4.2	-0.2	149	95	97	109	103	111	574	156	84	69	84	72	78	0.003	7.55	0.02
680	110.879	120.028	0.16	0.18	2.21	82	-0.86	1.78	80	-0.6	84	0.090	100	100	4.0	-0.2	148	95	97	110	103	111	536	154	84	70	84	73	78	0.002	7.31	0.02
690	112.637	121.921	0.18	0.19	2.21	82	-0.82	1.77	81	-0.7	84	0.090	108	107	3.8	-0.2	145	95	97	110	103	110	506	151	84	70	84	73	78	0.002	7.06	0.02
700	114.276	123.685	0.16	0.18	2.21	82	-0.77	1.78	81	-0.8	83	0.090	100	100	3.7	-0.1	143	95	97	110	103	110	488	149	84	70	84	73	78	0.002	6.95	0.02
710	115.917	125.450	0.16	0.18	2.21	83	-0.85	1.78	81	-0.7	83	0.090	100	100	3.6	-0.1	141	95	97	110	102	109	476	147	83	71	83	74	78	0.001	6.69	0.02
720	117.558	127.215	0.16	0.18	2.21	83	-1.01	1.77	81	-0.7	82	0.090	100	100	3.4	-0.2	139	95	97	109	102	108	466	145	83	71	83	74	78	0.001	6.76	0.02
730	119.200	128.980	0.16	0.18	2.20	83	-0.71	1.77	81	-0.6	81	0.090	100	100	3.3	-0.1	138	96	97	109	102	108	457	143	83	71	83	74	78	0.000	6.72	0.01

Wood Heater Test Data

Run: 2

Manufacturer: New Buck Stoves
Model: 91
Tracking No.: 2372
Project No.: 0567WS001N
Test Date: 28-May-19
Beginning Clock Time: 13:41

Total Sampling Time: 1230 min
Recording Interval: 10 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.009 (1) 0.996 (2) _____ (Amb)

Barometric Pressure:	Begin	Middle	End	Average
	29.45		29.39	29.42

0

OMNI Equipment Numbers: _____

PM Control Modules: 371, 372
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.230 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 18.91 ft/sec.
Initial Tunnel Flow: 211.0 scfm
Average Tunnel Flow: 210.8 scfm
Post-Test Leak Check (1): 0.000 cfm @ 12 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 8 in. Hg
Average Test Piece Fuel Moisture: 20.97 Dry Basis %

Technician Signature: _____

Velocity Traverse Data	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.064	0.086	0.090	0.084	0.060	0.086	0.090	0.080	0.091	"H2O
Temp:	84	83	83	83	83	83	83	83	83	°F

V_{strav} 19.12 ft/sec V_{scent} 20.44 ft/sec F_p 0.935

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)												Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface	Catalyst Exit	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
740	120.840	130.745	0.16	0.18	2.21	83	-0.84	1.78	81	-0.6	81	0.090	100	100	3.2	-0.1	137	96	97	109	102	108	448	142	83	72	83	74	77	0.000	6.51	0.02
750	122.482	132.512	0.16	0.18	2.21	82	-0.71	1.79	81	-0.9	80	0.090	100	100	3.1	-0.1	135	95	97	108	101	107	441	141	83	72	83	74	77	0.000	6.42	0.01
760	124.123	134.280	0.16	0.18	2.22	82	-0.77	1.78	80	-0.5	79	0.090	100	100	3.0	-0.1	134	95	96	107	101	107	442	139	83	72	82	74	76	0.000	6.47	0.02
770	125.764	136.049	0.16	0.18	2.23	82	-0.71	1.79	80	-0.7	79	0.090	100	100	2.9	-0.1	133	95	96	107	101	106	436	139	83	72	82	74	76	0.000	6.65	0.01
780	127.404	137.818	0.16	0.18	2.22	82	-1.03	1.78	80	-0.7	78	0.090	100	100	2.8	-0.1	132	95	96	107	100	106	441	138	83	72	82	74	76	0.000	6.72	0.02
790	129.044	139.586	0.16	0.18	2.22	82	-0.79	1.79	80	-0.8	77	0.090	100	100	2.6	-0.2	132	95	96	107	99	106	447	138	83	72	82	74	75	0.000	6.84	0.02
800	130.683	141.355	0.16	0.18	2.22	81	-0.73	1.79	79	-0.8	77	0.090	100	100	2.5	-0.1	131	94	96	107	99	105	453	138	83	72	82	74	75	0.000	6.87	0.02
810	132.323	143.121	0.16	0.18	2.22	81	-1.02	1.79	79	-0.6	77	0.090	100	100	2.4	-0.1	131	94	96	107	99	105	455	140	82	72	82	74	74	0.000	6.66	0.02
820	133.962	144.889	0.16	0.18	2.22	81	-1	1.79	79	-0.7	76	0.090	100	100	2.2	-0.18	131	94	96	107	98	105	449	139	82	72	82	74	74	0.000	6.6	0.02
830	135.601	146.656	0.16	0.18	2.22	80	-0.72	1.79	78	-0.8	75	0.090	100	100	2.2	-0.02	131	94	96	107	97	105	445	139	82	72	82	74	73	0.000	6.56	0.02
840	137.239	148.423	0.16	0.18	2.22	80	-0.95	1.79	78	-0.6	74	0.090	100	100	2.1	-0.1	130	94	96	107	97	105	455	138	82	71	82	74	72	0.000	7	0.02
850	138.874	150.189	0.16	0.18	2.21	79	-1.02	1.78	77	-0.6	74	0.090	100	100	1.9	-0.2	130	93	95	106	97	104	463	139	82	71	82	74	72	0.001	6.57	0.02
860	140.507	151.951	0.16	0.18	2.20	79	-0.99	1.78	77	-0.6	74	0.090	100	100	1.8	-0.1	130	93	95	106	96	104	451	139	82	71	82	73	72	0.000	6.42	0.02
870	142.141	153.712	0.16	0.18	2.21	79	-1.02	1.78	77	-0.7	73	0.090	100	99	1.8	0	130	93	95	106	96	104	445	138	82	71	82	73	71	0.000	6.26	0.02
880	143.773	155.472	0.16	0.18	2.21	78	-0.71	1.77	76	-0.8	73	0.090	100	100	1.7	-0.1	129	93	95	105	96	104	436	137	82	71	81	73	70	0.000	6.17	0.02
890	145.406	157.232	0.16	0.18	2.20	78	-0.73	1.78	76	-0.5	73	0.090	100	100	1.6	-0.1	128	92	95	104	96	103	430	136	82	71	81	73	70	0.000	6.08	0.02
900	147.037	158.992	0.16	0.18	2.21	77	-1.01	1.79	75	-0.6	72	0.090	100	100	1.4	-0.2	127	92	94	103	95	102	424	135	82	70	81	72	69	0.000	5.99	0.02
910	148.670	160.752	0.16	0.18	2.21	77	-1.02	1.78	75	-0.6	72	0.090	100	100	1.4	0	127	91	94	103	95	102	420	134	81	70	81	72	70	0.000	5.94	0.03
920	150.301	162.509	0.16	0.18	2.20	77	-0.69	1.79	75	-0.5	71	0.090	100	99	1.3	-0.08	126	91	94	102	95	102	414	133	81	70	81	72	70	0.000	5.85	0.03
930	151.931	164.265	0.16	0.18	2.21	76	-0.81	1.78	74	-0.6	71	0.090	100	100	1.2	-0.12	125	90	93	101	94	101	408	131	81	70	81	72	69	0.000	5.81	0.03
940	153.561	166.018	0.16	0.18	2.21	76	-0.84	1.78	74	-0.6	71	0.090	100	99	1.1	-0.1	124	90	93	101	94	100	405	131	82	69	81	71	69	0.000	5.73	0.03
950	155.187	167.770	0.16	0.18	2.19	75	-0.91	1.78	74	-0.8	71	0.090	100	99	1.1	0	124	90	93	100	94	100	401	130	82	69	81	71	69	0.000	5.74	0.03
960	156.813	169.520	0.16	0.18	2.19	75	-1.01	1.78	74	-0.8	70	0.090	100	99	1.0	-0.1	123	89	93	100	93	100	399	129	81	69	81	71	69	0.000	5.72	0.04
970	158.435	171.268	0.16	0.17	2.20	75	-0.91	1.76	73	-0.8	70	0.090	99	99	0.9	-0.1	123	88	92	99	93	99	398	129	81	69	81	71	68	0.000	5.64	0.04
980	160.064	173.027	0.16	0.18	2.23	75	-0.78	1.82	73	-0.6	69	0.090	100	100	0.9	0	122	87	91	98	93	98	396	129	81	69	81	71	68	0.000	5.23	0.09
990	161.701	174.804	0.16	0.18	2.22	75	-0.7	1.83	73	-0.5	70	0.090	100	101	0.8	-0.1	121	86	91	97	92	97	399	128	81	69	80	70	67	0.000	4.94	0.28
1000	163.323	176.552	0.16	0.17	2.22	74	-0.72	1.83	73	-0.5	70	0.090	100	99	0.7	-0.1	121	86	91	97	92	97	336	126	81	69	80	70	67	0.000	4.84	0.29
1010	164.945	178.300	0.16	0.17	2.22	74	-0.74	1.82	73	-0.5	70	0.090	100	99	0.7	0	121	86	91	97	92	97	334	126	81	69	80	70	67	0.000	4.73	0.31
1020	166.567	180.048	0.16	0.17	2.23	73	-0.82	1.82	73	-0.7	69	0.090	100	99	0.7	0	121	86	91	97	92	97	332	125	81	68	80	70	67	0.000	4.63	0.34
1030	168.189	181.796	0.16	0.17	2.23	73	-0.84	1.83	72	-0.6	69	0.090	100	99	0.6	-0.1	120	86	90	96	92	97	328	124	81	68	80	69	68	0.000	4.58	0.37
1040	169.811	183.544	0.16	0.17	2.22	73	-0.87	1.82	72	-0.7	69	0.090	100	99	0.5	-0.1	120	86	90	96	92	97	321	122	81	68	80	69	68	0.000	4.5	0.039
1050	171.433	185.292	0.16	0.17	2.23	73	-0.92	1.82	72	-0.5	69	0.090	100	99	0.4	-0.1	119	86	90	95	92	96	317	120	81	68	80	69	68	0.000	4.46	0.43
1060	173.055	187.040	0.16	0.17	2.23	73	-0.87	1.81	71	-0.7	68	0.090	100	99	0.4	0	117	91	90	95	91	97	305	106	81	68	80	69	66	0.000	5.83	0.59
1070	174.677	188.788	0.16	0.17	2.23	73	-0.72	1.82	71	-0.8	68	0.090	100	99	0.4	0	120	100	95	97	92	101	312	100	81	67	80	69	66	0.000	5.47	0.53
1080	176.299	190.536	0.16	0.17	2.21	73	-0.78	1.79	71	-0.8	68	0.090	100	99	0.3	-0.1	123	95	95	97	95	101	318	114	81	67	80	69	67	0.000	3.85	0.38
1090	177.921	192.284	0.16	0.17	2.23	73	-0.72	1.82	71	-0.8	68	0.090	100	99	0.3	0	120	88	91	95	93	97	302	117	82	67	80	69	67	0.000	3.77	0.48
1100	179.543	194.032	0.16	0.17	2.21	72	-0.78	1.81	71	-0.6	68	0.090	100	99	0.3	-0.02	118	93	91	95	91	98	287	101	81	67	80	69	66	0.000	4.94	0.67

Wood Heater Test Data

Run: 2

Manufacturer: New Buck Stoves
Model: 91
Tracking No.: 2372
Project No.: 0567WS001N
Test Date: 28-May-19
Beginning Clock Time: 13:41

Total Sampling Time: 1230 min
Recording Interval: 10 min
Background Sample Volume: ____ cubic feet

Meter Box Y Factor: 1.009 (1) 0.996 (2) ____ (Amb)

Barometric Pressure:	Begin	Middle	End	Average
	29.45		29.39	29.42

0

OMNI Equipment Numbers: ____

PM Control Modules: 371, 372
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.230 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 18.91 ft/sec.
Initial Tunnel Flow: 211.0 scfm
Average Tunnel Flow: 210.8 scfm
Post-Test Leak Check (1): 0.000 cfm @ 12 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 8 in. Hg
Average Test Piece Fuel Moisture: 20.97 Dry Basis %

Technician Signature: ____

Velocity Traverse Data	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.064	0.086	0.090	0.084	0.060	0.086	0.090	0.080	0.091	"H2O
Temp:	84	83	83	83	83	83	83	83	83	°F

V_{strav} 19.12 ft/sec V_{scent} 20.44 ft/sec F_p 0.935

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)													Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface	Catalyst Exit	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
1110	181.165	195.780	0.16	0.17	2.23	72	-0.69	1.82	71	-0.5	67	0.090	100	99	0.2	-0.08	120	101	95	96	92	101	286	98	81	67	80	68	66	0.000	4.15	0.63
1120	182.787	197.528	0.16	0.17	2.21	72	-0.68	1.82	71	-0.8	68	0.090	100	99	0.2	0	122	100	97	97	94	102	289	107	81	67	80	68	66	0.000	2.75	0.52
1130	184.409	199.276	0.16	0.17	2.22	72	-0.85	1.82	71	-0.6	68	0.090	100	99	0.2	0	119	89	91	94	93	97	258	110	81	67	80	68	66	0.000	2.58	0.69
1140	186.031	201.024	0.16	0.17	2.22	72	-0.97	1.82	71	-0.6	67	0.090	100	99	0.2	0	116	94	90	93	90	97	234	96	81	67	80	68	66	0.000	3.47	0.92
1150	187.653	202.772	0.16	0.17	2.22	72	-0.94	1.81	71	-0.7	67	0.090	100	99	0.1	-0.1	116	101	93	94	90	99	228	92	81	67	80	68	66	0.000	3.3	0.91
1160	189.275	204.520	0.16	0.17	2.21	72	-0.95	1.82	71	-0.5	68	0.090	100	99	0.1	0	116	105	95	94	91	100	223	91	81	67	80	68	66	0.000	3.25	0.9
1170	190.897	206.268	0.16	0.17	2.24	72	-0.72	1.82	71	-0.7	68	0.090	100	99	0.1	0	116	93	92	93	92	97	223	103	81	67	80	68	67	0.000	2.08	0.61
1180	192.519	208.016	0.16	0.17	2.24	72	-0.91	1.83	71	-0.8	68	0.090	100	99	0.0	-0.1	111	90	88	91	89	94	207	94	82	67	80	68	66	0.000	3.2	0.89
1190	194.141	209.764	0.16	0.17	2.24	72	-1	1.83	71	-0.8	68	0.090	100	99	0.0	0	110	96	90	90	88	95	205	89	81	67	80	68	67	0.000	2.88	0.8
1200	195.763	211.512	0.16	0.17	2.22	72	-1.02	1.82	71	-0.7	68	0.090	100	99	0.0	0	111	100	92	91	89	97	202	88	81	67	80	68	67	0.000	2.84	0.81
1210	197.385	213.260	0.16	0.17	2.19	72	-0.77	1.81	71	-0.5	69	0.090	100	99	0.0	0	111	103	93	91	90	98	198	87	81	67	80	69	68	0.000	2.79	0.79
1220	199.007	215.008	0.16	0.17	2.23	72	-0.82	1.81	71	-0.6	69	0.090	100	99	0.0	0	112	104	94	91	90	98	195	87	82	67	80	69	67	0.000	2.75	0.78
1230	200.629	216.756	0.16	0.17	2.20	72	-0.85	1.82	71	-0.5	70	0.090	100	100	0.0	0	112	105	94	91	91	99	190	86	82	67	80	69	68	0.000	2.61	0.73
Avg/Tot	200.629	216.756	0.16	0.18	2.21	79		1.79	77		77	0.090	100	100								89.0				69	82	69	73	0.006		

Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer:	New Buck Stoves	Equipment Numbers:	
Model:	91		
Tracking No.:	2372		
Project No.:	0567WS001N		
Run #:	2		
Date:	5/28/19		

TRAIN 1 (First Hour emissions)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	T148S	81.0	79.2	1.8
C. Rear filter catch	Filter				0.0
D. Probe catch*	Probe				0.0
E. Filter seals catch*	Seals				0.0

Sub-Total | Total Particulate, mg: | 1.8

TRAIN 1 (Post First Hour Change-out)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	T142AP	164.8	162.9	1.9
C. Rear filter catch	Filter				0.0
D. Probe catch*	Probe	28	114750.8	114749.9	0.9
E. Filter seals catch*	Seals	R799	3348.7	3346.3	2.4

Sub-Total | Total Particulate, mg: | 5.2

Train 1 Aggregate | Total Particulate, mg: | **7.0**

TRAIN 2

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	T142BP	158.4	156.6	1.8
B. Rear filter catch	Filter				0.0
C. Probe catch*	Probe	30	114328.7	114327.7	1.0
D. Filter seals catch*	Seals	R800	4117.7	4112.9	4.8

Total Particulate, mg: | **7.6**

AMBIENT

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch*	Filter				0.0

Total Particulate, mg: | **0.0**

*Particulate catch that results in a negative number, is assumed to be zero for probes and seals, negative numbers for filters are assumed to be part of the seal weight.

Component	Equations:
A. Front filter catch	Final (mg) - Tare (mg) = Particulate, mg
B. Rear filter catch	Final (mg) - Tare (mg) = Particulate, mg
C. Probe catch	Final (mg) - Tare (mg) = Particulate, mg

Technician Signature: 

Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: New Buck Stoves
Model: 91
Project No.: 0567WS001N
Tracking No.: 2372
Run: 2
Test Date: 05/28/19

Burn Rate	**0.54 kg/hr dry**
Average Tunnel Temperature	77 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	18.91 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	12648.6 dscf/hour
Average Delta p	0.090 inches H20
Total Time of Test	1230 minutes

	AMBIENT	SAMPLE TRAIN 1	SAMPLE TRAIN 2	FIRST HOUR FILTER (TRAIN 1)
Total Sample Volume - Vm	0.000 cubic feet	200.629 cubic feet	216.756 cubic feet	9.859 cubic feet
Average Gas Meter Temperature	73 degrees Fahrenheit	79 degrees Fahrenheit	77 degrees Fahrenheit	80 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	0.000 dscf	196.132 dscf	209.551 dscf	9.606 dscf
Total Particulates - m_n	0 mg	7 mg	7.6 mg	1.8 mg
Particulate Concentration (dry-standard) - C_r/C_s	0.000000 grams/dscf	0.00004 grams/dscf	0.00004 grams/dscf	0.00019 grams/dscf
Total Particulate Emissions - E_T	0.00 grams	9.25 grams	9.40 grams	2.37 grams
Particulate Emission Rate	0.00 grams/hour	0.45 grams/hour	0.46 grams/hour	2.37 grams/hour
Emissions Factor		0.84 g/kg	0.85 g/kg	0.97 g/kg
Difference from Average Total Particulate Emissions		0.07 grams	0.07 grams	
	Dual Train Comparison Results Are Acceptable			

FINAL AVERAGE RESULTS

Complete Test Run	
Total Particulate Emissions - E_T	9.33 grams
Particulate Emission Rate	**0.46 grams/hour**
Emissions Factor	0.85 grams/kg
First Hour Emissions	
Total Particulate Emissions - E_T	2.37 grams
Particulate Emission Rate	2.37 grams/hour
Emissions Factor	0.97 grams/kg
7.5% of Average Total Particulate Emissions	0.70 grams

QUALITY CHECKS

Filter Temps < 90 °F	NOT ACCEPTABLE
Filter Face Velocity (47 mm)	OK
Dryer Exit Temp < 80F	OK
Leakage Rate	OK
Ambient Temp (55-90°F)	OK
Negative Probe Weight Eval.	OK
Pro-Rate Variation	OK
Stove Surface ΔT	OK

Technician Signature: 

Wood Heater Efficiency Results - CSA B415.1

Manufacturer: New Buck Stoves
Model: 91
Date: 05/28/19
Run: 2
Control #: 0567WS001N
Test Duration: 1230
Output Category: I

Technician Signature: 

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	83.5%	90.3%
Combustion Efficiency	99.3%	99.3%
Heat Transfer Efficiency	84%	91.0%

Output Rate (kJ/h)	8,961	8,500	**(Btu/h)**
Burn Rate (kg/h)	0.54	1.19	**(lb/h)**
Input (kJ/h)	10,728	10,177	**(Btu/h)**

Test Load Weight (dry kg)	11.10	24.47	**dry lb**
MC wet (%)	17.33715419		
MC dry (%)	20.97		
Particulate (g)	0.46		
CO (g)	181		
Test Duration (h)	20.50		

Emissions	Particulate	CO
g/MJ Output	0.00	0.98
g/kg Dry Fuel	0.04	16.29
g/h	0.02	8.82
lb/MM Btu Output	0.01	2.29

Air/Fuel Ratio (A/F)	15.56

VERSION: **2.2** **12/14/2009**

Adjunct to ASTM E XXXX Wood Heater Cordwood Test Method - May 10, 2017 Version

Cordwood Fuel Load Calculators - 12 lb/ft^3 Nominal Load Density

Core 45-65% of Total Load Weight, Remainder 35-55% of Total Load Weight

Values to be input manually

For Usable Firebox Volumes up to 3.0 ft^3 - Low and Medium Fire

Nominal Required Load Density (wet basis)	12	lb/ft^3				
Usable Firebox Volume	2.61	ft^3				
Total Nom. Load Wt. Target	31.32	lb				
Total Load Wt. Allowable Range	29.75	to	32.89	lb		
Core Target Wt. Allowable Range	14.094	to	20.36	lb		
Remainder Load Wt. Allowable Range	10.96	to	17.23	lb		
						Mid-Point
Core Load Fuel Pc. Wt. Allowable Range	4.70	to	7.83	lb		6.26
Remainder Load Pc. Wt. Allowable Range	3.13	to	9.40	lb		6.26
	Pc. #					
Core Load Piece Wt. Actual	1	7.20	lb	In Range		
	2	5.00	lb	In Range		
	3	6.30	lb	In Range		
Core Load Total. Wt. Actual		18.50	lb	In Range		
	Pc. #					
Remainder Load Piece Wt.	1	7.60	lb	In Range		
(2 or 3 Pcs.)	2	4.10	lb	In Range		
	3		lb	NA		
Remainder Load Piece Weight Ratio - Small/Large		54%		In Range		≤ 67%
Remainder Load Tot. Wt. Act		11.70	lb	In Range		
Total Load Wt. Actual		30.20	lb	In Range		
Core % of Total Wt.		61%		In Range		45-65%
Remainder % of Total Wt.		39%		In Range		35-55%
Actual Load % of Nominal Target		96%		In Range		95-105%
Actual Fuel Load Density		11.6	lb/ft^3			
Allowable Charcoal Bed Wt. Range (lb)	3.1	to	6.0			Mid-Point
Actual Charcoal Bed Wt.		3.1	lb	In Range		4.5
Actual Fuel Load Ending Wt.		0.6	lb	Valid Test		≥ 90%
Total Wt. of Fuel Burned During Test Run lb.		29.6	lb			

Fuel Piece Moisture Reading (%-dry basis)

1	2	3	Ave.		Pc. Wt. Dry Basis			
23.8	18.1	20.3	20.7	In Range	5.96	lb	2.71	kg
21.9	25.9	18.1	22.0	In Range	4.10	lb	1.86	kg
22.3	21	18.2	20.5	In Range	5.23	lb	2.37	kg
20.2	22.6	22.8	21.9	In Range	6.24	lb	2.83	kg
20.8	18.1	20.5	19.8	In Range	3.42	lb	1.55	kg
			NA	NA	NA	lb	NA	kg

Total Load Ave. MC % (dry basis)	21.0	In Range			
Total Load Ave. MC % (wet basis)	17.4				
Total Test Load Weight (dry basis) →			24.95	lb	11.32 kg
Total Fuel Weight Burned During Test Run (dry basis)			24.3	lb	11.05 kg

OMNI-Test Laboratories, Inc.

Wood Heater Run Sheets

Client: New Buck Corp. Project Number: 0567WS001N Run Number: 2
Model: 91 Tracking Number: 2372 Date: 5/28/19
Test Crew: B Davis
OMNI Equipment ID numbers: 132, 650, 283A, 371, 372, 410, 559, 592, 594, 637, IGNITION 29

Wood Heater Run Notes

Air Control Settings

Primary:

Fully closed
Boost Air fully closed

Secondary: N/A

Tertiary/Pilot: N/A

Fan: On low

Preburn Notes

Time	Notes
	N/A

Test Notes

Sketch test fuel configuration:

See photo

Start up procedures & Timeline:

Bypass: Not used
Fuel loaded by: 50 seconds
Door closed at: 1:00
Primary air: closed at 10 min

Notes: Boost Air closed @ 5 min
FAN on Low entire test

Time	Notes
60	change front filter on tree A

Technician Signature: BD Date: 8/5/19

OMNI-Test Laboratories, Inc.

Wood Heater Run Sheets

Client: New Buck Corp. Project Number: 0567WS001N Run Number: 2
Model: 91 Tracking Number: 2372 Date: 5/28/15
Test Crew: B Davis
OMNI Equipment ID numbers: 132, 650, 283A, 371, 372, 410, 559, 592, 594, C37, 16-140TR029

Wood Heater Supplemental Data

Start Time: 13:41 5/27 Booth #: N/A
Stop Time: 10:11 5/28

Stack Gas Leak Check:
Initial: good Final: good

Sample Train Leak Check:
A: 0.0 @ 12 "Hg
B: 0.0 @ 8 "Hg

Calibrations: Span Gas CO_2: 10.08 CO: 2.53

	Pre Test		Post Test	
	Zero	Span	Zero	Span
Time	see Run 1			
CO_2			0.08	9.97
CO			0.056	2.562

Air Velocity (ft/min): Initial: 250 Final: 250
Scale Audit (lbs): Initial: 10.0 Final: 10.0
Pitot Tube Leak Test: Initial: good Final: good
Stack Diameter (in): 8"
Induced Draft: 0.0
% Smoke Capture: 100%
Flue Pipe Cleaned Prior to First Test in Series:
Date: 5/27/15 Initials: BC

	Initial	Middle	Ending
P_b (in/Hg)	29.45		29.39
RH (%)	49%		60.4
Ambient (°F)	78		68

Tunnel Traverse

Microtector Reading	dP (in H_2O)	T(°F)
	.064	84
	.086	83
	.090	83
	.084	83
	.060	83
	.086	83
	.090	83
	.080	83
Center:		
	.091	83

Tunnel Static Pressure (in H_2O):	
Beginning of Test	End of Test
-.23	-.23

Background Filter Volume: N/A

Technician Signature: [signature] Date: 8/5/15

Run 3
High Burn 2-minute data

Non-Sampling High Burn

Wood Heater Test Data

Run: 3

Manufacturer: New Buck Stoves
Model: 91
Tracking No.: 2372
Project No.: 0567WS001N
Test Date: 30-May-19
Beginning Clock Time: 09:24

Total Sampling Time: 172 min
Recording Interval: 2 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.009 (1) 0.996 (2) _____ (Amb)

Barometric Pressure:	Begin	Middle	End	Average
	29.33		29.34	29.34

OMNI Equipment Numbers: _____

PM Control Modules: 371, 372
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: _____ "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: #DIV/0! ft/sec.
Initial Tunnel Flow: #DIV/0! scfm
Average Tunnel Flow: #DIV/0! scfm
Post-Test Leak Check (1): _____ cfm @ _____ in. Hg
Post-Test Leak Check (2): _____ cfm @ _____ in. Hg
Average Test Piece Fuel Moisture: 22.62 Dry Basis %

Technician Signature: 

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP										"H2O
Temp:										°F

V_{strav} _____ ft/sec V_{scent} _____ ft/sec F_p _____

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)												Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface	Catalyst Exit	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
0															12.8		63	62	63	63	63	63		158					64	0.000		
2															12.4		64	63	63	63	63	63		570					64	0.029		
4															11.7		65	62	64	64	63	64		300					64	0.063		
6															11.2		66	62	65	66	65	65		271					64	0.029		
8															10.7		69	63	67	68	66	67		312					64	0.039		
10															10.1		75	63	69	72	69	70		344					64	0.047		
12															9.6		83	63	73	77	72	74		366					64	0.050		
14															9.1		94	63	76	83	76	78		380					64	0.052		
16															8.8		106	63	81	89	80	84		383					65	0.053		
18															8.4		119	63	85	95	85	89		385					65	0.053		
20															8.0		132	64	90	101	90	95		391					66	0.053		
22															7.6		145	65	95	106	95	101		399					66	0.054		
24															7.3		159	66	100	112	100	107		405					65	0.055		
26															7.1		172	67	104	117	105	113		411					66	0.056		
28															6.9		185	68	108	121	109	118		414					66	0.057		
30															6.6		198	69	111	125	113	123		414					66	0.057		
32															6.3		210	71	115	129	116	128		422					67	0.057		
34															6.0		221	73	119	133	119	133		431					67	0.058		
36															5.6		231	75	116	139	121	136		445					68	0.060		
38															5.3		236	77	113	142	122	138		440					69	0.060		
40															5.0		238	79	110	143	122	138		433					70	0.060		
42															4.9		239	81	108	144	121	139		425					71	0.058		
44															4.6		237	82	107	144	121	138		419					71	0.057		
46															4.3		235	83	107	144	120	138		419					71	0.056		
48															4.1		233	84	107	144	120	138		417					72	0.056		
50															3.9		230	86	107	144	120	137		410					72	0.055		
52															3.6		227	87	107	144	120	137		405					72	0.055		
54															3.4		225	88	107	145	120	137		404					72	0.054		
56															3.2		222	89	108	145	121	137		401					70	0.054		
58															3.0		219	90	108	146	120	137		397					71	0.053		
60															2.8		218	92	111	147	121	138		344					71	0.053		
62															25.4		217	93	112	147	122	138		382					72	0.049		
64															24.9		215	93	112	146	122	138		403					71	0.054		
66															24.4		215	94	112	144	123	138		423					72	0.058		
68															23.8		215	95	112	143	124	138		441					73	0.060		
70															23.2		218	95	112	142	126	139		453					73	0.062		
72															22.7		222	96	113	142	129	140		462					73	0.063		

Wood Heater Test Data

Run: 3

Manufacturer: New Buck Stoves
Model: 91
Tracking No.: 2372
Project No.: 0567WS001N
Test Date: 30-May-19
Beginning Clock Time: 09:24

Total Sampling Time: 172 min
Recording Interval: 2 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.009 (1) 0.996 (2) _____ (Amb)

Barometric Pressure:	Begin	Middle	End	Average
	29.33		29.34	29.34

OMNI Equipment Numbers: _____

PM Control Modules: 371, 372
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: _____ "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: #DIV/0! ft/sec.
Initial Tunnel Flow: #DIV/0! scfm
Average Tunnel Flow: #DIV/0! scfm
Post-Test Leak Check (1): _____ cfm @ _____ in. Hg
Post-Test Leak Check (2): _____ cfm @ _____ in. Hg
Average Test Piece Fuel Moisture: 22.62 Dry Basis %

Technician Signature: 

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP										"H2O
Temp:										°F

V_{strav} _____ ft/sec V_{scent} _____ ft/sec F_p _____

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)												Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface	Catalyst Exit	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
74															22.2		226	97	113	142	131	142		462					74	0.064		
76															21.5		231	97	114	142	134	144		465					74	0.064		
78															21.0		237	98	115	143	136	146		469					74	0.065		
80															20.5		243	98	116	145	138	148		472					75	0.064		
82															19.9		249	98	117	146	140	150		474					75	0.065		
84															19.4		255	99	118	149	143	153		479					76	0.065		
86															18.9		260	99	120	152	145	155		478					76	0.065		
88															18.3		264	100	121	155	147	157		480					76	0.065		
90															17.9		268	100	122	159	149	160		478					76	0.065		
92															17.4		272	101	124	162	151	162		481					76	0.064		
94															16.9		275	101	125	166	153	164		481					77	0.065		
96															16.4		278	102	126	169	155	166		482					77	0.065		
98															16.0		280	103	127	172	158	168		484					77	0.065		
100															15.4		283	103	129	176	160	170		487					77	0.065		
102															14.9		285	104	130	178	162	172		489					77	0.065		
104															14.5		288	104	131	180	165	174		491					77	0.066		
106															13.9		291	105	132	183	167	176		493					78	0.066		
108															13.4		294	105	133	185	169	177		492					78	0.066		
110															13.0		297	105	134	187	171	179		493					79	0.066		
112															12.5		300	106	135	190	174	181		495					78	0.066		
114															12.0		302	106	136	192	176	182		493					78	0.067		
116															11.7		305	107	138	195	178	185		492					79	0.065		
118															11.2		307	108	139	197	179	186		493					79	0.065		
120															10.8		308	108	140	199	180	187		496					80	0.065		
122															10.3		310	109	141	201	182	189		499					77	0.065		
124															9.9		311	109	141	203	181	189		497					76	0.065		
126															9.5		312	109	142	205	181	190		498					76	0.065		
128															9.1		313	109	143	207	182	191		499					76	0.065		
130															8.7		314	110	144	209	182	192		501					75	0.065		
132															8.3		316	110	144	211	182	193		502					76	0.065		
134															8.0		317	110	145	212	182	193		503					75	0.065		
136															7.6		319	111	145	213	183	194		505					75	0.065		
138															7.2		321	110	146	214	183	195		503					76	0.066		
140															6.9		322	111	146	215	182	195		502					75	0.065		
142															6.6		322	111	147	216	182	196		495					76	0.064		
144															6.3		322	112	147	217	182	196		493					77	0.064		
146															6.0		321	112	148	219	181	196		491					76	0.063		

Wood Heater Test Data

Run: 3

Manufacturer: New Buck Stoves
Model: 91
Tracking No.: 2372
Project No.: 0567WS001N
Test Date: 30-May-19
Beginning Clock Time: 09:24

Total Sampling Time: 172 min
Recording Interval: 2 min
Background Sample Volume: ____ cubic feet

Meter Box Y Factor: 1.009 (1) 0.996 (2) ____ (Amb)

Barometric Pressure:

Begin	Middle	End	Average
29.33		29.34	29.34 0

OMNI Equipment Numbers: ____

PM Control Modules: 371, 372
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: ____ "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: #DIV/0! ft/sec.
Initial Tunnel Flow: #DIV/0! scfm
Average Tunnel Flow: #DIV/0! scfm
Post-Test Leak Check (1): ____ cfm @ ____ in. Hg
Post-Test Leak Check (2): ____ cfm @ ____ in. Hg
Average Test Piece Fuel Moisture: 22.62 Dry Basis %

Technician Signature: ____

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP										"H2O
Temp:										°F

V_{strav} ____ ft/sec V_{scent} ____ ft/sec F_p ____

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)												Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface	Catalyst Exit	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
148															5.6		320	113	149	220	181	197		492					75	0.063		
150															5.4		318	115	150	222	181	197		489					72	0.063		
152															5.1		316	115	151	222	180	197		488					77	0.063		
154															4.8		314	115	151	222	180	196		485					77	0.062		
156															4.5		313	116	152	223	181	197		484					78	0.062		
158															4.3		311	116	152	223	180	196		484					77	0.062		
160															4.1		309	117	151	223	180	196		480					77	0.061		
162															3.8		307	117	151	223	179	195		477					77	0.061		
164															3.6		306	118	151	225	178	196		473					80	0.060		
166															3.4		304	119	151	225	177	195		470					81	0.060		
168															3.1		302	119	151	226	176	195		467					81	0.058		
170															2.9		299	121	152	227	176	195		465					80	0.058		
172															2.7															0.058		
Avg/Tot	0.000	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!								62.8				#DIV/0!	#DIV/0!	#DIV/0!	73	0.059		

Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: New Buck Stoves
Model: 91
Project No.: 0567WS001N
Tracking No.: 2372
Run: 3
Test Date: 05/30/19

Burn Rate	**4.52 kg/hr dry**
Total Time of Test	110 minutes

	AMBIENT	SAMPLE TRAIN 1	SAMPLE TRAIN 2	FIRST HOUR FILTER (TRAIN 1)
	#DIV/0!			

FINAL AVERAGE RESULTS

QUALITY CHECKS

Ambient Temp (55-90°F)	OK

Technician Signature: _____

Adjunct to ASTM E XXXX Wood Heater Cordwood Test Method - May 10, 2017 Version

Cordwood Fuel Load Calculators - 10 lb/ft^3 Nominal Load Density

Core 45-65% of Total Load Weight, Remainder 35-55% of Total Load Weight

Values to be input manually

For All Usable Firebox Volumes - High Fire Test Only

Nominal Required Load Density (wet basis)	10	lb/ft^3				
Usable Firebox Volume	2.61	ft^3				
Total Nom. Load Wt. Target	26.10	lb				
Total Load Wt. Allowable Range	24.80	to	27.40	lb		
Core Target Wt. Allowable Range	11.70	to	17.00	lb		
Remainder Load Wt. Allowable Range	9.10	to	14.40	lb		
						Mid-Point
Core Load Pc. Wt. Allowable Range	3.90	to	6.50	lb		5.20
Remainder Load Pc. Wt. Allowable Range	2.60	to	14.40	lb		8.50
	Pc. #					
Core Load Piece Wt. Actual	1	4.80	lb	In Range		
	2	4.30	lb	In Range		
	3	4.50	lb	In Range		
Core Load Total. Wt. Actual		13.60	lb	In Range		
	Pc. #					
Remainder Load Piece Wt.	1	7.20	lb	In Range		
(1 to 3 Pcs.)	2	4.90	lb	In Range		
	3		lb	NA		
Remainder Load Tot. Wt. Act		12.10	lb	In Range		
Total Load Wt. Actual		25.70	lb	In Range		
Core % of Total Wt.		53%		In Range	45-65%	
Remainder % of Total Wt.		47%		In Range	35-55%	
Actual Load % of Nominal Target		98%		In Range	95-105%	
Actual Fuel Load Density		9.8	lb/ft^3			
Kindling and Start-up Fuel						
Maximim Kindling Wt. (20% of Tot. Load Wt.)		5.14	lb			
Actual Kindling Wt.		5.10	lb	In Range	19.8%	
Maximum Start-up Fuel Wt. (30% of Tot. Load Wt.)		7.71	lb			
Actual Start-up Fuel Wt.		7.70	lb	In Range	30.0%	
Allowable Residual Start-up Fuel Wt. Range	2.6	to	5.1	lb		Mid-Point
Actual Residual Start-up Fuel Wt.		2.8	lb	In Range		3.9
Total Wt. All Fuel Added (wet basis)		38.50	lb			
High Fire Test Run End Point Range	Low		High			Mid-Point
Based on Fuel Load Wt. (w/tares)	2.3	to	2.8	lb		2.6
Actual Fuel Load Ending Wt.		2.7	lb	In Range		

Fuel Piece Moisture Reading (%-dry basis)

1	2	3	Ave.		Pc. Wt. Dry Basis			
21.6	23.4	22.5	22.5	In Range	3.92	lb	1.78	kg
25.2	25.3	23	24.5	In Range	3.45	lb	1.57	kg
18	22.9	25.2	22.0	In Range	3.69	lb	1.67	kg
25.8	24.6	21.7	24.0	In Range	5.80	lb	2.63	kg
19	19.4	21.7	20.0	In Range	4.08	lb	1.85	kg
			NA	NA	NA	lb	NA	kg

Total Load Ave. MC (%-dry basis)	22.7	In Range		
Total Load Ave. MC % (wet basis)	18.5			
Total Test Load Weight (dry basis) →			20.95 lb	9.50 kg

Kindling Moisture (%-dry basis)

12	11.9	11.8	11.9	In Range	4.56	lb	2.07	kg

Start-up Fuel Moisture Readings (%-dry basis)

21.3	24.7	18.4	21.5	In Range	6.34	lb	2.88	kg

Total Wt. All Fuel Added (dry basis) →			31.84 lb	14.44 kg
Total Wt. All Fuel Burned (dry basis) →			26.3 lb	11.9 kg

OMNI-Test Laboratories, Inc.

Wood Heater Run Sheets

Client: New Buck Corp. Project Number: 0567WS001N Run Number: 3
Model: 91 Tracking Number: 2372 Date: 5/30/19
Test Crew: B G Jans
OMNI Equipment ID numbers: 132, 650, 233A, 371, 372, 410, 559, 593, 599, 637, 16-140TT029

Wood Heater Run Notes

Air Control Settings

Primary: Fully open

Secondary: N/A

Tertiary/Pilot: N/A

Fan: On High

Preburn Notes

Time	Notes
Ø	Torch used for 40 seconds to ignite top down kindling/startup fuel. Bypass open until 3:00 then closed. Fuel loading door open until 2:00 then closed. Shotgun/boost Air open until 3:00 min. then closed. FAN turned on ± 37 min, operated on high.
60	Leveled coal bed and TARed 2.8 lbs.

Test Notes

Sketch test fuel configuration:

See photo

Start up procedures & Timeline:

Bypass: Closed by 1:00
Fuel loaded by: 1:00
Door closed at: 1:00
Primary air: Fully open entire test

Notes: ~~Boost Air fully open entire test~~ Not used.
FAN on High entire test.

Time	Notes
	N/A Non-Sampling Run.

Technician Signature: [signature] Date: 5/5/19

Run 4

Low Burn

Wood Heater Test Fuel Data - ASTM E2780

Manufacturer:	New Buck Stoves
Model:	91
Tracking No.:	2372
Project No.:	0567WS001N
Test Date:	5/30/2019
Run No.:	4

Firebox Volume (ft^3):	
Fuel Piece Length (in):	
2x4 Crib Weight (lb):	
4x4 Crib Weight (lb):	

Total Fuel Weight (Dry Basis, lb):	24.0	
Fuel Density (lb/ft^3, Dry Basis):		Out of Range
Loading Density (lb/ft^3, Wet Basis):		Out of Range
2x4 Percentage:		N/A

Coal Bed Range (20-25%): **Input Crib Weights!**

Test Fuel Piece	Weight (lb)	Size	Readings (Dry Basis %)			Dry Weight (lb)
1	4.9		24.1	18.3	20.1	4.06
2	7		27.4	24.5	23.9	5.59
3	6.9		19.7	26.5	23.7	5.60
4	7.2		26.4	22.1	22.4	5.82
5	4		24.3	23.0	22.3	3.25

Spacer Readings (Dry Basis %)			

Technician Signature: _____

Wood Heater Test Data

Run: 4

Manufacturer: New Buck Stoves
Model: 91
Tracking No.: 2372
Project No.: 0567WS001N
Test Date: 30-May-19
Beginning Clock Time: 12:39

Total Sampling Time: 1050 min
Recording Interval: 10 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.009 (1) 0.996 (2) _____ (Amb)

Barometric Pressure:	Begin	Middle	End	Average
	29.34		29.39	29.37

0

OMNI Equipment Numbers: _____

PM Control Modules: 371, 372
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.250 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 18.58 ft/sec.
Initial Tunnel Flow: 209.9 scfm
Average Tunnel Flow: 205.0 scfm
Post-Test Leak Check (1): 0.000 cfm @ 6 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 6 in. Hg
Average Test Piece Fuel Moisture: 23.25 Dry Basis %

Technician Signature:

Velocity Traverse Data										
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.064	0.088	0.094	0.084	0.060	0.084	0.086	0.084	0.103	"H2O
Temp:	91	91	91	91	91	91	91	91	91	°F

V_{strav} 19.35 ft/sec V_{scent} 21.95 ft/sec F_p 0.882

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)													Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface	Catalyst Exit	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
0	0.000	0.000			2.28	82	-0.63	1.40	81	0	127	0.080			29.7		284	130	151	217	179	192	816	451	85	69	84	75	82		6.1	0.04
10	1.613	1.725	0.16	0.17	2.24	83	-0.95	1.79	82	-0.3	109	0.090	104	103	27.1	-2.6	302	131	152	207	173	193	1265	376	87	58	88	61	82		11.91	0.4
20	3.248	3.496	0.16	0.18	2.19	84	-1.09	1.83	83	-0.2	102	0.090	105	105	25.9	-1.2	319	130	143	188	161	188	1063	306	89	55	88	56	83		9.65	0.03
30	4.873	5.284	0.16	0.18	2.17	84	-1.06	1.82	84	-0.3	98	0.090	104	105	25.0	-0.9	294	126	134	171	150	175	934	275	87	53	86	53	83		9.24	0.04
40	6.501	7.068	0.16	0.18	2.17	85	-0.84	1.80	84	-0.6	96	0.090	104	105	24.1	-0.9	270	124	128	158	142	164	1011	267	85	51	86	51	82		10.02	0.09
50	8.129	8.848	0.16	0.18	2.18	85	-1	1.80	85	-0.3	94	0.090	104	104	23.3	-0.8	255	120	123	148	134	156	1000	259	86	50	86	51	83		9.92	0.07
60	9.760	10.629	0.16	0.18	2.20	86	-0.74	1.79	85	-0.3	94	0.090	104	104	22.4	-0.9	244	116	119	141	130	150	982	254	87	50	85	50	82		9.98	0.05
70	11.404	12.408	0.16	0.18	2.21	86	-0.77	1.80	85	-0.4	93	0.090	104	104	21.7	-0.7	234	113	116	136	125	145	937	247	85	50	85	50	82		9.25	0.03
80	13.044	14.187	0.16	0.18	2.21	86	-0.97	1.79	85	-0.5	92	0.090	104	104	21.1	-0.6	223	111	113	132	123	140	877	239	85	50	85	50	82		8.61	0.02
90	14.684	15.965	0.16	0.18	2.19	86	-0.72	1.79	85	-0.7	92	0.090	104	104	20.4	-0.7	211	107	110	128	120	135	862	233	85	50	85	50	81		8.8	0.02
100	16.321	17.741	0.16	0.18	2.19	86	-0.64	1.79	85	-0.6	92	0.080	110	110	19.7	-0.7	204	106	109	125	117	132	889	232	86	51	85	51	82		9.28	0.03
110	17.956	19.517	0.16	0.18	2.18	86	-0.9	1.78	85	-0.5	92	0.090	104	104	19.1	-0.6	201	105	108	123	116	131	896	230	85	52	85	51	82		9	0.03
120	19.588	21.288	0.16	0.18	2.17	86	-0.66	1.78	85	-0.4	92	0.090	104	103	18.5	-0.6	198	104	107	122	114	129	869	227	85	54	85	53	82		9.15	0.03
130	21.220	23.058	0.16	0.18	2.18	86	-0.96	1.78	85	-0.5	91	0.090	103	103	18.0	-0.5	195	104	106	120	114	128	863	224	85	55	85	54	82		9.14	0.03
140	22.852	24.829	0.16	0.18	2.19	86	-0.95	1.77	85	-0.6	92	0.090	104	103	17.3	-0.7	192	103	105	119	114	127	851	222	84	55	85	55	82		9	0.03
150	24.485	26.598	0.16	0.18	2.23	86	-0.99	1.77	85	-0.5	92	0.090	104	103	16.8	-0.5	189	102	105	118	113	125	818	218	86	56	85	56	82		8.43	0.02
160	26.140	28.365	0.17	0.18	2.24	86	-0.93	1.76	86	-0.7	91	0.090	105	103	16.4	-0.4	184	102	105	118	113	124	768	212	85	56	85	57	82		8.04	0.02
170	27.786	30.144	0.16	0.18	2.17	86	-0.87	1.81	86	-0.6	91	0.090	104	103	15.9	-0.5	180	102	104	118	113	123	738	208	85	58	85	59	83		7.97	0.02
180	29.424	31.934	0.16	0.18	2.17	87	-0.76	1.81	86	-0.6	91	0.090	104	104	15.4	-0.5	175	101	104	117	113	122	739	205	85	60	85	61	83		8.12	0.02
190	31.062	33.722	0.16	0.18	2.18	87	-0.91	1.80	86	-0.9	91	0.090	104	104	14.9	-0.5	173	101	104	117	112	121	775	206	85	62	85	63	83		0.32	0
200	32.699	35.504	0.16	0.18	2.19	87	-0.68	1.79	87	-0.6	91	0.090	104	103	14.4	-0.5	173	100	104	116	112	121	809	207	85	64	85	64	83		8.73	0.03
210	34.336	37.283	0.16	0.18	2.19	87	-0.66	1.79	87	-0.7	91	0.090	104	103	13.9	-0.5	175	100	103	116	113	121	844	210	85	65	85	65	83		8.98	0.03
220	35.972	39.055	0.16	0.18	2.18	87	-0.96	1.76	87	-1	90	0.090	103	103	13.3	-0.56	177	100	103	116	113	122	884	213	85	66	85	66	83		9.35	0.04
230	37.606	40.814	0.16	0.18	2.19	87	-0.68	1.74	87	-1	91	0.090	103	102	12.7	-0.64	181	99	103	116	111	122	932	217	86	67	85	67	83		9.66	0.05
240	39.247	42.594	0.16	0.18	2.23	87	-0.97	1.81	87	-1.1	92	0.090	104	103	12.2	-0.5	187	100	103	117	112	124	975	223	85	68	85	68	83		10.12	0.06
250	40.895	44.340	0.16	0.17	2.22	87	-0.88	1.59	87	-1.3	92	0.090	104	101	11.5	-0.7	194	100	104	118	113	126	1060	228	85	69	85	69	83		11.15	0.12
260	42.544	45.890	0.16	0.16	2.21	88	-0.65	1.12	87	-2.1	92	0.090	104	90	10.8	-0.7	206	100	104	119	114	129	1141	236	85	70	85	70	84		11.64	0.12
270	44.191	47.507	0.16	0.16	2.23	88	-1	1.36	87	-5.1	92	0.090	104	94	10.2	-0.6	217	99	104	119	114	131	1029	237	85	70	85	71	84		9.66	0.09
280	45.839	49.236	0.16	0.17	2.20	88	-0.75	1.64	87	-1	93	0.090	104	101	9.7	-0.5	216	100	105	121	116	132	926	231	85	71	86	72	84		8.59	0.05
290	47.489	51.013	0.17	0.18	2.21	88	-0.81	1.80	87	-1.4	92	0.090	104	103	9.2	-0.5	207	100	105	121	116	130	826	223	85	72	85	72	84		8.12	0.03
300	49.138	52.802	0.16	0.18	2.22	88	-1	1.80	87	-1.7	92	0.090	104	104	8.9	-0.3	198	100	105	121	116	128	791	216	85	72	85	73	84		7.83	0.02
310	50.788	54.593	0.17	0.18	2.19	88	-0.65	1.80	87	-1.3	91	0.090	104	104	8.5	-0.4	190	100	105	120	115	126	748	209	85	72	85	73	84		7.49	0.02
320	52.432	56.380	0.16	0.18	2.20	88	-0.78	1.80	87	-1.5	91	0.100	99	98	8.2	-0.3	183	101	106	119	116	125	711	204	85	72	85	74	84		7.13	0.01
330	54.077	58.162	0.16	0.18	2.21	88	-0.92	1.78	87	-1.4	91	0.100	99	98	7.9	-0.3	177	101	106	119	117	124	679	199	85	73	85	75	84		7.08	0.01
340	55.725	59.944	0.16	0.18	2.20	88	-0.98	1.79	87	-1.5	90	0.100	99	98	7.6	-0.3	172	101	106	118	116	123	666	195	87	73	85	75	84		7.18	0.01
350	57.372	61.726	0.16	0.18	2.21	88	-0.69	1.79	88	-1.2	91	0.100	99	98	7.3	-0.3	168	101	105	117	115	121	659	193	85	74	85	76	84		7.2	0.01
360	59.016	63.509	0.16	0.18	2.22	89	-1	1.79	88	-1.4	90	0.100	98	98	7.1	-0.2	165	100	105	116	115	120	657	190	85	74	85	76	83		7.21	0.01

Wood Heater Test Data

Run: 4

Manufacturer: New Buck Stoves
Model: 91
Tracking No.: 2372
Project No.: 0567WS001N
Test Date: 30-May-19
Beginning Clock Time: 12:39

Total Sampling Time: 1050 min
Recording Interval: 10 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.009 (1) 0.996 (2) _____ (Amb)

Barometric Pressure:	Begin	Middle	End	Average
	29.34		29.39	29.37

0

OMNI Equipment Numbers: _____

PM Control Modules: 371, 372
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.250 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 18.58 ft/sec.
Initial Tunnel Flow: 209.9 scfm
Average Tunnel Flow: 205.0 scfm
Post-Test Leak Check (1): 0.000 cfm @ 6 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 6 in. Hg
Average Test Piece Fuel Moisture: 23.25 Dry Basis %

Technician Signature: _____

Velocity Traverse Data	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.064	0.088	0.094	0.084	0.060	0.084	0.086	0.084	0.103	"H2O
Temp:	91	91	91	91	91	91	91	91	91	°F

V_{strav} 19.35 ft/sec V_{scent} 21.95 ft/sec F_p 0.882

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)													Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface	Catalyst Exit	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
370	60.662	65.289	0.16	0.18	2.22	89	-1	1.80	88	-1.4	90	0.100	98	98	6.7	-0.36	163	100	105	116	115	120	649	188	85	66	85	69	84		7.19	0.01
380	62.308	67.073	0.16	0.18	2.19	89	-0.92	1.79	88	-1.5	90	0.100	98	98	6.5	-0.24	162	100	105	115	115	119	637	187	85	62	85	65	84		6.96	0.01
390	63.953	68.858	0.16	0.18	2.20	88	-0.67	1.80	88	-1.6	89	0.100	98	98	6.2	-0.3	160	100	105	114	115	119	612	184	85	60	85	62	83		6.61	0
400	65.597	70.641	0.16	0.18	2.19	88	-0.99	1.78	88	-1.5	88	0.100	98	98	6.1	-0.1	158	99	104	114	115	118	570	179	84	59	85	62	83		6.18	0
410	67.239	72.423	0.16	0.18	2.21	88	-0.71	1.80	87	-1.3	87	0.100	98	98	5.9	-0.2	154	98	103	113	114	116	531	173	86	59	84	62	82		6.11	0
420	68.885	74.214	0.16	0.18	2.21	88	-0.76	1.81	87	-1.6	86	0.100	98	98	5.8	-0.1	151	98	103	112	113	115	510	170	84	60	85	62	82		5.83	0
430	70.531	76.009	0.16	0.18	2.19	88	-0.68	1.82	87	-1.2	85	0.100	98	98	5.7	-0.1	147	97	102	111	111	114	489	165	84	60	84	62	82		5.7	0
440	72.179	77.809	0.16	0.18	2.19	87	-1.01	1.82	87	-1.6	85	0.100	98	99	5.5	-0.2	144	97	101	110	111	113	474	162	85	61	84	62	81		5.63	0.02
450	73.823	79.606	0.16	0.18	2.21	87	-0.66	1.81	86	-1.3	84	0.100	98	98	5.4	-0.1	142	96	101	109	110	112	462	160	84	62	84	62	80		5.56	0.02
460	75.468	81.401	0.16	0.18	2.21	87	-0.71	1.82	86	-1.5	83	0.100	98	98	5.4	0	140	96	100	108	109	111	454	157	85	62	84	63	79		5.62	0.02
470	77.113	83.201	0.16	0.18	2.20	86	-0.67	1.84	86	-1.4	83	0.100	98	99	5.3	-0.1	138	95	99	108	108	110	447	155	84	63	84	64	79		5.6	0.02
480	78.759	85.005	0.16	0.18	2.21	86	-0.67	1.84	85	-1.3	82	0.100	98	99	5.1	-0.2	136	94	99	107	107	109	440	154	85	64	83	65	79		5.54	0.02
490	80.403	86.809	0.16	0.18	2.22	86	-0.74	1.85	85	-1.3	82	0.100	98	99	5.1	0	135	94	99	107	106	108	434	152	83	64	83	65	79		5.55	0.02
500	82.048	88.613	0.16	0.18	2.22	85	-0.95	1.84	84	-1.3	81	0.100	98	99	5.0	-0.1	134	94	98	106	107	108	430	151	85	65	83	66	78		5.55	0.02
510	83.692	90.415	0.16	0.18	2.21	85	-0.66	1.84	84	-1.6	80	0.100	98	99	4.9	-0.1	132	93	97	106	106	107	428	150	84	66	83	67	78		5.55	0.02
520	85.336	92.218	0.16	0.18	2.19	84	-0.68	1.84	84	-1.3	80	0.100	98	99	4.8	-0.1	132	93	97	105	105	106	426	149	84	66	83	67	77		5.52	0.02
530	86.980	94.020	0.16	0.18	2.22	84	-0.67	1.84	83	-1.3	79	0.100	98	99	4.7	-0.1	131	93	97	105	105	106	426	148	84	66	83	67	77		5.57	0.03
540	88.622	95.821	0.16	0.18	2.19	84	-0.8	1.84	83	-1.3	79	0.100	98	99	4.6	-0.1	130	92	96	104	104	105	429	148	83	67	83	68	76		5.65	0.03
550	90.264	97.623	0.16	0.18	2.23	83	-0.85	1.84	82	-1.4	79	0.100	98	99	4.5	-0.1	130	92	96	104	104	105	437	148	84	67	83	68	76		5.84	0.03
560	91.905	99.425	0.16	0.18	2.22	83	-0.97	1.83	82	-1.4	78	0.100	98	99	4.4	-0.06	129	91	95	103	104	104	436	148	83	67	83	69	76		5.64	0.03
570	93.546	101.229	0.16	0.18	2.22	82	-0.83	1.84	81	-1.3	78	0.100	98	99	4.3	-0.14	129	91	95	103	103	104	429	147	84	67	83	69	76		5.54	0.03
580	95.187	103.032	0.16	0.18	2.23	82	-0.89	1.84	81	-1.5	78	0.100	98	99	4.2	-0.1	128	91	95	103	103	104	428	146	84	68	83	69	75		5.58	0.03
590	96.829	104.834	0.16	0.18	2.21	82	-0.79	1.86	81	-1.5	77	0.090	104	104	4.2	0	128	91	94	102	102	103	428	145	83	68	83	69	75		5.56	0.04
600	98.470	106.638	0.16	0.18	2.21	81	-0.98	1.85	81	-1.5	77	0.100	98	99	4.0	-0.2	127	90	94	102	102	103	427	145	84	68	83	70	75		5.81	0.05
610	100.110	108.441	0.16	0.18	2.20	81	-0.94	1.86	80	-1.2	77	0.100	98	99	3.9	-0.1	127	90	94	102	101	103	435	146	83	68	82	70	74		5.74	0.03
620	101.749	110.245	0.16	0.18	2.21	81	-0.77	1.86	80	-1.5	76	0.100	98	99	3.8	-0.1	127	90	94	102	101	103	437	146	83	68	82	70	74		5.67	0.03
630	103.389	112.047	0.16	0.18	2.22	80	-0.7	1.84	80	-1.5	76	0.100	98	99	3.7	-0.1	127	90	93	101	101	102	435	146	83	68	82	70	74		5.68	0.03
640	105.028	113.847	0.16	0.18	2.21	80	-0.98	1.86	79	-1.6	76	0.100	98	99	3.6	-0.1	127	90	93	100	101	102	433	145	83	68	82	70	74		5.7	0.03
650	106.668	115.646	0.16	0.18	2.22	80	-0.98	1.86	79	-1.5	76	0.100	98	99	3.5	-0.1	127	90	93	100	100	102	440	145	83	68	82	70	74		5.87	0.04
660	108.308	117.443	0.16	0.18	2.22	80	-0.92	1.85	79	-1.6	76	0.100	98	99	3.3	-0.2	127	90	93	100	100	102	454	146	83	68	82	70	73		5.94	0.04
670	109.947	119.237	0.16	0.18	2.21	80	-0.68	1.84	79	-1.5	76	0.100	98	99	3.2	-0.1	127	90	93	100	100	102	451	147	83	69	82	71	73		5.81	0.04
680	111.585	121.026	0.16	0.18	2.20	80	-0.93	1.84	78	-1.5	75	0.100	98	99	3.1	-0.1	127	90	93	100	99	102	440	147	83	69	82	71	75		5.71	0.04
690	113.220	122.813	0.16	0.18	2.23	79	-0.99	1.83	78	-1.5	76	0.100	98	99	2.9	-0.2	127	90	93	100	99	102	432	146	82	69	82	71	74		5.7	0.04
700	114.857	124.598	0.16	0.18	2.23	79	-0.82	1.82	78	-1.3	75	0.100	98	98	2.8	-0.1	127	90	93	100	99	102	426	145	83	69	82	71	74		5.75	0.04
710	116.494	126.387	0.16	0.18	2.23	79	-0.83	1.84	78	-1.5	75	0.100	98	99	2.7	-0.1	126	89	93	100	98	101	425	144	83	69	82	71	74		5.82	0.04
720	118.132	128.175	0.16	0.18	2.24	79	-0.67	1.84	78	-1.4	75	0.100	98	99	2.6	-0.1	126	89	93	100	98	101	428	144	82	69	82	71	74		5.94	0.04
730	119.770	129.965	0.16	0.18	2.22	79	-0.99	1.85	78	-1.5	75	0.100	98	99	2.5	-0.1	125	89	93	100	98	101	431	145	82	69	82	71	72		5.93	0.04

Wood Heater Test Data

Run: 4

Manufacturer: New Buck Stoves
Model: 91
Tracking No.: 2372
Project No.: 0567WS001N
Test Date: 30-May-19
Beginning Clock Time: 12:39

Total Sampling Time: 1050 min
Recording Interval: 10 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.009 (1) 0.996 (2) _____ (Amb)

Barometric Pressure:	Begin	Middle	End	Average
	29.34		29.39	29.37

0

OMNI Equipment Numbers: _____

PM Control Modules: 371, 372
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.250 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 18.58 ft/sec.
Initial Tunnel Flow: 209.9 scfm
Average Tunnel Flow: 205.0 scfm
Post-Test Leak Check (1): 0.000 cfm @ 6 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 6 in. Hg
Average Test Piece Fuel Moisture: 23.25 Dry Basis %

Technician Signature: _____

Velocity Traverse Data	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.064	0.088	0.094	0.084	0.060	0.084	0.086	0.084	0.103	"H2O
Temp:	91	91	91	91	91	91	91	91	91	°F

V_{strav} 19.35 ft/sec V_{scent} 21.95 ft/sec F_p 0.882

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)													Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface	Catalyst Exit	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
740	121.407	131.754	0.16	0.18	2.23	79	-0.98	1.85	77	-1.2	74	0.100	98	99	2.3	-0.2	126	89	94	101	98	102	431	145	83	69	82	71	72		5.87	0.04
750	123.123	133.630	0.17	0.19	2.22	79	-0.95	1.84	77	-1.4	74	0.100	103	104	2.3	0	126	89	94	101	98	102	434	146	83	69	82	71	72		5.87	0.04
760	124.760	135.420	0.16	0.18	2.22	78	-0.8	1.85	77	-1.2	74	0.100	98	99	2.2	-0.1	126	89	94	101	97	101	434	146	82	69	81	71	71		5.79	0.04
770	126.397	137.210	0.16	0.18	2.23	78	-0.72	1.85	77	-1.3	74	0.100	98	99	2.1	-0.14	126	88	94	101	97	101	431	146	83	69	81	71	73		5.83	0.05
780	128.034	139.000	0.16	0.18	2.20	78	-0.92	1.85	76	-1.3	74	0.100	98	99	1.9	-0.16	126	88	94	101	97	101	433	146	83	69	82	70	72		5.84	0.05
790	129.669	140.789	0.16	0.18	2.21	78	-0.93	1.86	76	-1.5	73	0.100	98	99	1.8	-0.1	126	88	94	101	96	101	431	146	82	69	82	70	73		5.74	0.05
800	131.306	142.579	0.16	0.18	2.22	77	-0.96	1.86	76	-1.2	73	0.100	98	99	1.7	-0.1	126	88	94	101	96	101	427	146	82	69	82	70	72		5.6	0.05
810	132.942	144.365	0.16	0.18	2.23	77	-0.87	1.85	76	-1.5	73	0.100	98	99	1.6	-0.1	125	88	93	101	96	101	423	145	83	69	81	70	72		5.54	0.05
820	134.577	146.154	0.16	0.18	2.24	77	-0.65	1.85	76	-1.5	73	0.100	98	99	1.5	-0.1	125	88	93	101	95	100	421	145	82	69	81	70	72		5.49	0.05
830	136.214	147.944	0.16	0.18	2.22	77	-0.88	1.86	75	-1.4	73	0.100	98	99	1.4	-0.1	125	87	93	100	95	100	422	145	82	68	82	70	72		5.34	0.05
840	137.849	149.736	0.16	0.18	2.22	77	-0.98	1.86	75	-1.5	72	0.100	98	99	1.3	-0.1	124	87	93	100	95	100	420	144	83	68	82	70	72		5.3	0.05
850	139.484	151.526	0.16	0.18	2.20	76	-0.97	1.85	75	-1.2	72	0.100	98	99	1.2	-0.1	123	87	92	99	94	99	413	143	82	68	81	69	71		5.07	0.06
860	141.118	153.316	0.16	0.18	2.22	76	-0.67	1.86	75	-1.4	72	0.100	98	99	1.1	-0.1	123	86	92	99	94	99	405	142	82	68	81	69	71		5.13	0.07
870	142.753	155.109	0.16	0.18	2.24	76	-0.88	1.86	75	-1.3	72	0.100	98	99	1.1	0	121	86	92	98	93	98	398	140	82	68	81	69	71		4.95	0.1
880	144.387	156.900	0.16	0.18	2.23	76	-0.98	1.86	75	-1.3	71	0.100	98	99	1.0	-0.1	120	85	91	97	93	97	400	139	82	68	81	69	71		4.91	0.24
890	146.020	158.691	0.16	0.18	2.21	76	-0.78	1.87	74	-1.2	71	0.100	98	99	0.9	-0.1	119	85	91	97	92	97	337	136	81	68	81	69	70		4.67	0.45
900	147.652	160.483	0.16	0.18	2.23	75	-0.94	1.87	74	-1.3	70	0.100	98	99	0.8	-0.1	118	85	90	96	92	96	318	133	82	68	81	69	70		4.35	0.54
910	149.286	162.276	0.16	0.18	2.23	75	-0.82	1.86	74	-1.4	70	0.100	98	99	0.8	0	116	84	90	95	92	95	306	130	82	68	81	69	69		4.06	0.65
920	150.918	164.067	0.16	0.18	2.24	75	-0.98	1.86	74	-1.4	69	0.100	98	99	0.7	-0.1	114	84	90	94	92	95	283	124	81	68	81	69	68		3.67	0.71
930	152.550	165.858	0.16	0.18	2.22	74	-0.96	1.85	73	-1.4	68	0.100	98	99	0.7	0	116	94	95	96	93	99	274	108	81	67	81	68	67		4.79	0.93
940	154.180	167.647	0.16	0.18	2.23	74	-0.98	1.86	73	-1.4	69	0.100	98	99	0.7	0	120	93	96	98	96	101	286	120	82	67	81	68	69		3.31	0.74
950	155.810	169.438	0.16	0.18	2.22	74	-0.82	1.86	73	-1.5	69	0.100	98	99	0.6	-0.1	117	87	91	96	95	97	279	122	81	67	80	68	68		4.21	0.88
960	157.438	171.227	0.16	0.18	2.21	74	-0.64	1.86	73	-1.3	69	0.100	98	99	0.4	-0.2	113	84	88	94	92	94	301	120	81	67	80	68	67		4.31	0.61
970	159.067	173.015	0.16	0.18	2.21	74	-0.67	1.86	73	-1.3	68	0.100	98	99	0.4	0	110	82	87	92	91	92	305	119	82	67	81	68	68		4.28	0.53
980	160.694	174.803	0.16	0.18	2.22	73	-0.65	1.87	72	-1.4	68	0.100	98	99	0.3	-0.1	109	81	85	91	90	91	294	118	81	67	81	68	68		3.98	0.57
990	162.323	176.593	0.16	0.18	2.23	73	-0.68	1.85	72	-1.5	68	0.100	98	99	0.2	-0.1	107	81	84	89	89	90	283	116	81	67	80	67	68		3.81	0.61
1000	163.949	178.381	0.16	0.18	2.21	73	-0.77	1.86	72	-1.5	68	0.100	98	99	0.1	-0.1	106	80	84	88	88	89	270	114	82	67	80	67	68		3.4	0.58
1010	165.578	180.169	0.16	0.18	2.21	73	-0.77	1.86	72	-1.3	68	0.100	98	99	0.1	0	104	80	83	87	87	88	247	111	82	67	80	67	68		3.15	0.61
1020	166.929	181.658	0.14	0.15	2.23	73	-0.69	1.85	72	-1.3	68	0.100	81	83	0.0	-0.1	103	79	83	87	87	88	243	110	81	67	80	67	67		3.02	0.61
1030	168.556	183.442	0.16	0.18	2.19	72	-0.88	1.85	72	-1.5	66	0.100	98	99	0.0	0	104	85	84	88	87	90	238	95	82	66	80	67	65		4.27	0.82
1040	170.179	185.224	0.16	0.18	2.22	72	-0.82	1.84	71	-1.5	67	0.100	98	99	0.0	0	105	82	84	87	88	89	233	106	81	66	80	67	68		2.52	0.57
1050	171.803	187.004	0.16	0.18	2.21	72	-0.76	1.84	71	-1.4	67	0.100	98	99	0.0	0	102	80	82	86	86	87	215	100	81	66	80	67	66		2.69	0.62
Avg/Tot	171.803	187.004	0.16	0.18	2.21	82		1.81	81		82	0.097	100	100								105.0				65	83	66	77	#DIV/0!		

Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer:	New Buck Stoves	Equipment Numbers:	
Model:	91		
Tracking No.:	2372		
Project No.:	0567WS001N		
Run #:	4		
Date:	5/30/19		

TRAIN 1 (First Hour emissions)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	T149S	82.1	78.9	3.2
C. Rear filter catch	Filter				0.0
D. Probe catch*	Probe				0.0
E. Filter seals catch*	Seals				0.0

Sub-Total | Total Particulate, mg: | 3.2

TRAIN 1 (Post First Hour Change-out)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	T143AP	158.8	157.0	1.8
C. Rear filter catch	Filter				0.0
D. Probe catch*	Probe	31	114367.7	114366.4	1.3
E. Filter seals catch*	Seals	R801	3555.3	3552.2	3.1

Sub-Total | Total Particulate, mg: | 6.2

Train 1 Aggregate | Total Particulate, mg: | **9.4**

TRAIN 2

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	T143BP	162.3	156.2	6.1
B. Rear filter catch	Filter	T150	80.5	79.4	1.1
C. Probe catch*	Probe	32	114741.9	114740.9	1.0
D. Filter seals catch*	Seals	R802	3553.9	3551.8	2.1

Total Particulate, mg: | **10.3**

AMBIENT

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch*	Filter				0.0

Total Particulate, mg: | **0.0**

*Particulate catch that results in a negative number, is assumed to be zero for probes and seals, negative numbers for filters are assumed to be part of the seal weight.

Component	Equations:
A. Front filter catch	Final (mg) - Tare (mg) = Particulate, mg
B. Rear filter catch	Final (mg) - Tare (mg) = Particulate, mg
C. Probe catch	Final (mg) - Tare (mg) = Particulate, mg

Technician Signature: 

Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: New Buck Stoves
Model: 91
Project No.: 0567WS001N
Tracking No.: 2372
Run: 4
Test Date: 05/30/19

Burn Rate	**0.62 kg/hr dry**
Average Tunnel Temperature	82 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	18.58 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	12301.2 dscf/hour
Average Delta p	0.097 inches H20
Total Time of Test	1050 minutes

	AMBIENT	SAMPLE TRAIN 1	SAMPLE TRAIN 2	FIRST HOUR FILTER (TRAIN 1)
Total Sample Volume - Vm	0.000 cubic feet	171.803 cubic feet	187.004 cubic feet	9.760 cubic feet
Average Gas Meter Temperature	77 degrees Fahrenheit	82 degrees Fahrenheit	81 degrees Fahrenheit	86 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	0.000 dscf	166.567 dscf	179.085 dscf	9.393 dscf
Total Particulates - m_n	0 mg	9.4 mg	10.3 mg	3.2 mg
Particulate Concentration (dry-standard) - C_r/C_s	0.000000 grams/dscf	0.00006 grams/dscf	0.00006 grams/dscf	0.00034 grams/dscf
Total Particulate Emissions - E_T	0.00 grams	12.15 grams	12.38 grams	4.19 grams
Particulate Emission Rate	0.00 grams/hour	0.69 grams/hour	0.71 grams/hour	4.19 grams/hour
Emissions Factor		1.12 g/kg	1.14 g/kg	1.56 g/kg
Difference from Average Total Particulate Emissions		0.12 grams	0.12 grams	
	Dual Train Comparison Results Are Acceptable			

FINAL AVERAGE RESULTS

Complete Test Run	
Total Particulate Emissions - E_T	12.26 grams
Particulate Emission Rate	**0.70 grams/hour**
Emissions Factor	1.13 grams/kg
First Hour Emissions	
Total Particulate Emissions - E_T	4.19 grams
Particulate Emission Rate	4.19 grams/hour
Emissions Factor	1.56 grams/kg
7.5% of Average Total Particulate Emissions	0.92 grams

QUALITY CHECKS

Filter Temps < 90 °F	OK
Filter Face Velocity (47 mm)	OK
Dryer Exit Temp < 80F	OK
Leakage Rate	OK
Ambient Temp (55-90°F)	OK
Negative Probe Weight Eval.	OK
Pro-Rate Variation	OK
Stove Surface ΔT	OK

Technician Signature: 

Wood Heater Efficiency Results - CSA B415.1

Manufacturer: New Buck Stoves
Model: 91
Date: 05/30/19
Run: 4
Control #: 0567WS001N
Test Duration: 1050
Output Category: I

Technician Signature: 

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	80.3%	86.8%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	81%	87.2%

Output Rate (kJ/h)	9,939	9,428	**(Btu/h)**
Burn Rate (kg/h)	0.62	1.38	**(lb/h)**
Input (kJ/h)	12,377	11,741	**(Btu/h)**

Test Load Weight (dry kg)	10.93	24.10	**dry lb**
MC wet (%)	18.86190296		
MC dry (%)	23.25		
Particulate (g)	0.70		
CO (g)	164		
Test Duration (h)	17.50		

Emissions	Particulate	CO
g/MJ Output	0.00	0.94
g/kg Dry Fuel	0.06	14.97
g/h	0.04	9.35
lb/MM Btu Output	0.01	2.19

Air/Fuel Ratio (A/F)	16.39

VERSION: **2.2** **12/14/2009**

Adjunct to ASTM E XXXX Wood Heater Cordwood Test Method - May 10, 2017 Version

Cordwood Fuel Load Calculators - 12 lb/ft^3 Nominal Load Density

Core 45-65% of Total Load Weight, Remainder 35-55% of Total Load Weight

Values to be input manually

For Usable Firebox Volumes up to 3.0 ft^3 - Low and Medium Fire

Nominal Required Load Density (wet basis)	12	lb/ft^3				
Usable Firebox Volume	2.61	ft^3				
Total Nom. Load Wt. Target	31.32	lb				
Total Load Wt. Allowable Range	29.75	to	32.89	lb		
Core Target Wt. Allowable Range	14.094	to	20.36	lb		
Remainder Load Wt. Allowable Range	10.96	to	17.23	lb		
						Mid-Point
Core Load Fuel Pc. Wt. Allowable Range	4.70	to	7.83	lb		6.26
Remainder Load Pc. Wt. Allowable Range	3.13	to	9.40	lb		6.26
	Pc. #					
Core Load Piece Wt. Actual	1	4.90	lb		In Range	
	2	7.00	lb		In Range	
	3	6.90	lb		In Range	
Core Load Total. Wt. Actual		18.80	lb		In Range	
	Pc. #					
Remainder Load Piece Wt.	1	7.20	lb		In Range	
(2 or 3 Pcs.)	2	4.00	lb		In Range	
	3		lb		NA	
Remainder Load Piece Weight Ratio - Small/Large		56%			In Range	≤ 67%
Remainder Load Tot. Wt. Act		11.20	lb		In Range	
Total Load Wt. Actual		30.00	lb		In Range	
Core % of Total Wt.		63%			In Range	45-65%
Remainder % of Total Wt.		37%			In Range	35-55%
Actual Load % of Nominal Target		96%			In Range	95-105%
Actual Fuel Load Density		11.5	lb/ft^3			
Allowable Charcoal Bed Wt. Range (lb)	3.1	to	6.0			Mid-Point
Actual Charcoal Bed Wt.		3.2	lb		In Range	4.5
Actual Fuel Load Ending Wt.		0.3	lb		Valid Test	≥ 90%
Total Wt. of Fuel Burned During Test Run lb.		29.7	lb			

Fuel Piece Moisture Reading (%-dry basis)

1	2	3	Ave.		Pc. Wt. Dry Basis			
24.1	18.3	20.1	20.8	In Range	4.06	lb	1.84	kg
27.4	24.5	23.9	25.3	In Range	5.59	lb	2.53	kg
19.7	26.5	23.7	23.3	In Range	5.60	lb	2.54	kg
26.4	22.1	22.4	23.6	In Range	5.82	lb	2.64	kg
24.3	23	22.3	23.2	In Range	3.25	lb	1.47	kg
			NA	NA	NA	lb	NA	kg

Total Load Ave. MC % (dry basis)	23.4	In Range			
Total Load Ave. MC % (wet basis)	19.0				
Total Test Load Weight (dry basis) →			24.31	lb	11.03 kg
Total Fuel Weight Burned During Test Run (dry basis)			24.0	lb	10.89 kg

OMNI-Test Laboratories, Inc.

Wood Heater Run Sheets

Client: New Buck Corp. Project Number: 0567WS001N Run Number: 4
Model: 91 Tracking Number: Date: 5/30/19
Test Crew: BD Avis
OMNI Equipment ID numbers: 132, 650, 283A, 371, 372, 410, 559, 592, 594, 637, 10-MOTT029

Wood Heater Supplemental Data

Start Time: 1239
Stop Time: ~~1309~~ 0604

Booth #: N/A

Stack Gas Leak Check:
Initial: good Final: good

Sample Train Leak Check:
A: 00 @ 6 "Hg
B: 0.0 @ 6 "Hg

Calibrations: Span Gas CO_2: 10.08 CO: 2.53

	Pre Test		Post Test	
	Zero	Span	Zero	Span
Time	1211	1212	0618	0618
CO_2	0.00	10.03	0.04	9.94
CO	0.000	2.530	0.048	2.571

Air Velocity (ft/min): Initial: <50 Final: <50
Scale Audit (lbs): Initial: 10.0 Final: 10.0
Pitot Tube Leak Test: Initial: good Final: good
Stack Diameter (in): 8"
Induced Draft: 0.0
% Smoke Capture: 100
Flue Pipe Cleaned Prior to First Test in Series:
Date: 5/22/19 Initials: BJ2

	Initial	Middle	Ending
P_b (in/Hg)	29.34		29.39
RH (%)	50		52%
Ambient (°F)	82		66

Tunnel Traverse

Microtector Reading	dP (in H_2O)	T(°F)
	.064	91
	.088	91
	.094	91
	.084	91
	.060	91
	.084	91
	.086	91
	.084	91
Center:		
	.103	91

Tunnel Static Pressure (in H_2O):	
Beginning of Test	End of Test
-.25	-.25

Background Filter Volume: N/A

Technician Signature: BD Avis Date: 5/5/19

OMNI-Test Laboratories, Inc.

Wood Heater Run Sheets

Client: New Buck Corp. Project Number: 0567WS001N Run Number: 4
Model: 91 Tracking Number: 2372 Date: 5/30/19
Test Crew: B Davis
OMNI Equipment ID numbers: 132, 650, 283A, 371, 372, 410, 559, 592, 594, 637, 16-140TT029

Wood Heater Run Notes

Air Control Settings

Primary:

0.125" from full closed
measured in Left opening (looking from front)

Secondary: ______

Tertiary/Pilot: ______

Fan: ______

Preburn Notes

Time	Notes

Test Notes

Sketch test fuel configuration:

See photo

Start up procedures & Timeline:

Bypass: Not used
Fuel loaded by: 60 seconds
Door closed at: 60 seconds
Primary air: fully open until 7:00 then set to test setting of 0.125"

Notes: boost Air fully open until 6:00 then fully closed
Fan on medium entire test

Time	Notes
60	Changed front filter on train A
247	Changed front filter in train B
15hrs 40min	Re-positioned fuel after 4 weight loss in two 10 min Readings

Technician Signature: B Davis Date: 8/5/19

Section 4

Quality Assurance/Quality Control

QUALITY ASSURANCE/QUALITY CONTROL

OMNI follows the guidelines of ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories," and the quality assurance/quality control (QA/QC) procedures found in *OMNI*'s Quality Assurance Manual.

OMNI's scope of accreditation includes, but is not limited to, the following:

- ANSI (American National Standards Institute) for certification of product to safety standards.
- To perform product safety testing by the International Accreditation Service, Inc. (formerly ICBO ES) under accreditation as a testing laboratory designated TL-130.
- To perform product safety testing as a "Certification Organization" by the Standards Council of Canada (SCC).
- Serving as a testing laboratory for the certification of wood heaters by the U.S. Environmental Protection Agency.

This report is issued within the scope of *OMNI*'s accreditation. Accreditation certificates are available upon request.

The manufacturing facilities and quality control system for the production of the 91 at New Buck Corporation were evaluated to determine if sufficient to maintain conformance with OMNI's requirements for product certification. OMNI has concluded that the manufacturing facilities, processes, and quality control system are adequate to produce the appliance congruous with the standards and model codes to which it was evaluated.

Sample Analysis

Analysis Worksheets

Tared Filter, Probe, and O-Ring Data

OMNI-Test Laboratories, Inc.

Wood Heater Run Sheets

Client: New Buck Corp. Project Number: 0567WS001N Run Number: 1
Model: 91 Tracking Number: 2372 Date: 5/28/19
Test Crew: BDAVIS
OMNI Equipment ID numbers: 132, 150, 283A, 371, 372, 410, 559, 592, 594, C37, IC-1407S029

ASTM E2515 Lab Sheet

Assembled By: BDAVIS

Date/Time in Dessicator: 5/31/19

	Weighing #1	Weighing #2	Weighing #3	Weighing #4	Weighing #5
Date/Time:	6/4/19 1315	6/7/19 1140	6/10/19 0820		
R/H %:	15.3	23.7	14.7		
Temp:	73.9	72.1	74.4		
200 mg Audit:	200.0	200.0	200.1		
2 g Audit:	2000.1	2000.2	2000.2		
100 g Audit:	99997.8	99997.9	99997.8		
Initials:	BD	BD	BD		

Train	Element	ID #	Tare (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)
A (First Hour)	Front Filter	T146S	78.8	83.2	83.2	✓		
	Rear Filter							
	Probe							
	O-Ring Set							
A (Remainder)	Front Filter	T141AP	164.4	167.4	on 167.0 ~~+164.4~~	167.8	✓	
	Rear Filter							
	Probe	23	114076.1	114078.0	114077.9	✓		
	O-Ring Set	R797	3401.0	3406.0	3404.0	3404.0	✓	
B	Front Filter	T141BP	163.9	170.2	on 170.1 ~~+163.9~~	✓		
	Rear Filter	T147S	79.3	83.9	84.2	84.2	✓	
	Probe	25	114299.0	114300.5	114300.6	✓		
	O-Ring Set	R798	3289.5	3291.7	3290.3	3290.4	✓	
BG	Filter							

Technician Signature: BD Date: 8/3/19

OMNI-Test Laboratories, Inc.

Wood Heater Run Sheets

Client: New Buck Corp. Project Number: 0567WS001N Run Number: 2

Model: 91 Tracking Number: 2372 Date: 5/28/19

Test Crew: BDavis

OMNI Equipment ID numbers: 637, 2834, 592

ASTM E2515 Lab Sheet

Assembled By:

BDavis

Date/Time in Dessicator:

5/31/19

	Weighing #1	Weighing #2	Weighing #3	Weighing #4	Weighing #5
	Date/Time: 6/4/19 1300	Date/Time: 6/7/19 1140	Date/Time: 6/10/19 0800	Date/Time: 6/11/19 0800	Date/Time:
	R/H %: 15.3	R/H %: 23.7	R/H %: 14.7	R/H %: 14.3	R/H %:
	Temp: 73.9	Temp: 72.1	Temp: 74.4	Temp: 76.2	Temp:
	200 mg Audit: 200.0	200 mg Audit: 200.0	200 mg Audit: 200.1	200 mg Audit: 200.1	200 mg Audit:
	2 g Audit: 2000.1	2 g Audit: 2000.2	2 g Audit: 2000.2	2 g Audit: 2000.2	2 g Audit:
	100 g Audit: 99997.8	100 g Audit 99997.9	100 g Audit 99997.8	100 g Audit 99997.7	100 g Audit
	Initials: BL	Initials: BL	Initials: BL	Initials: BL	Initials:

Train	Element	ID #	Tare (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)
A (First Hour)	Front Filter	T148S	79.2	80.9	81.0 ✓			
	Rear Filter							
	Probe							
	O-Ring Set							
A (Remainder)	Front Filter	T142AP	162.9	164.8	164.8 ✓			
	Rear Filter							
	Probe	28	114749.9	114750.8	114750.8 ✓			
	O-Ring Set	R799	3346.3	3350.5 ✓	3348.6	3348.7 ✓		
B	Front Filter	T142BP	156.6	158.4	158.4 ✓			
	Rear Filter							
	Probe	30	114327.7	114328.7	114328.7 ✓			
	O-Ring Set	R800	4112.9	4119.1	4118.0	4117.7	4117.7 ✓	
BG	Filter							

Technician Signature: BDavis Date: 8/5/19

OMNI-Test Laboratories, Inc.

Wood Heater Run Sheets

Client: New Buck Corp. Project Number: 0567WS001N Run Number: 4

Model: 91 Tracking Number: 2372 Date: 5/30/19

Test Crew: B Daus

OMNI Equipment ID numbers: 637, 283A, 592

ASTM E2515 Lab Sheet

Assembled By:

B Daus

Date/Time in Dessicator:

5/31/19

	Weighing #1	Weighing #2	Weighing #3	Weighing #4	Weighing #5
	Date/Time: 6/4/19 1315	Date/Time: 6/7/19 1440	Date/Time: 6/10/19 0800	Date/Time:	Date/Time:
	R/H %: 15.3	R/H %: 23.7	R/H %: 14.7	R/H %:	R/H %:
	Temp: 73.9	Temp: 72.1	Temp: 74.4	Temp:	Temp:
	200 mg Audit: 200.0	200 mg Audit:	200 mg Audit: 200.1	200 mg Audit:	200 mg Audit:
	2 g Audit: 2000.1	2 g Audit:	2 g Audit: 2000.2	2 g Audit:	2 g Audit:
	100 g Audit: 99997.8	100 g Audit	100 g Audit 99997.8	100 g Audit	100 g Audit
	Initials: BL	Initials: BL	Initials: BL	Initials:	Initials:

Train	Element	ID #	Tare (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)
A (First Hour)	Front Filter	T149S	78.9	82.0	82.1	✓		
	Rear Filter							
	Probe							
	O-Ring Set							
A (Remainder)	Front Filter	T143AP	157.0	158.7	158.8	✓		
	Rear Filter							
	Probe	31	114366.4	114367.6	114367.7	✓		
	O-Ring Set	R801	3552.2	3556.4	3555.4	3555.3	✓	
B	Front Filter	T143BP	156.2	162.4	162.3	✓		
	Rear Filter	T150S	79.4	80.4	80.5	✓		
	Probe	32	114740.9	114742.1	114741.9	✓		
	O-Ring Set	R802	3551.8	3554.4	3553.8	3353.9	✓	
BG	Filter							

Technician Signature: B Daus Date: 8/5/19

Tare Sheet: (check one) **Probes**_____ **47mm Filters**_____ **100mm Filters**_____ **O-Ring Pair**✓

Prepared By: B Davis Balance ID #: Omni-00637 Thermohygrometer ID #: Omni-00592 Audit Weight ID #/Mass: Omni-00283A / 5g

Placed in Dessicator: Date: 5/17/19 Time: 0925 ID #	Date: 5/20/19 Time: 0925 RH %: 17.4 T (°F): 71.2 Audit: 5000.0 mg	Date: 5/21/19 Time: 0813 RH %: 13.8 T (°F): 70.8 Audit: 5000.1	Date: 5/23/19 Time: 0917 RH %: 14.0 T (°F): 72.6 Audit: 5000.1	Date: 5/24/19 Time: 0814 RH %: 14.6 T (°F): 73.7 Audit: 5000.0	Date Used	Project Number	Run No.
R797	3400.8	3401.0	–		5/28/19	0567WS001N	1
R798	3289.3	3289.5	–		↓	↓	↓
R799	3346.0	3346.5	3346.3	–			2
R800	4113.0	4112.9	–		↓		↓
R801	3552.2	3552.5	3552.0	3552.2	– 5/30/19		4
R802	3551.9	3552.2	3551.8	3551.8	– ↓	↓	↓
R803	3499.0	3499.4	3499.1	3499.1			
R804	3620.7	3620.9	–				
R805	3283.6	3283.5	–				
R806	3381.4	3381.7	3381.5	–			
R807	3532.9	3533.0	–				
R808	3549.9	3550.2	3550.0	–			
R809	3319.7	3320.1	3319.6	3319.6	–		
R810	3578.5	3578.9	3578.7	–			
R811	3572.7	3573.2	3573.1	–			
R812	4057.9	4058.2	4058.0	–			
R813	3355.6	3355.7	–				
R814	3555.6	3555.8	–				
R815	3390.9	3390.7	–				
R816	3326.2	3326.2	–				
	Initials: BR	Initials: BR	Initials: BR	Initials: BR			

Final Technician Signature: B Davis Date: 5/21/19 Evaluator signature: M. Morgan

Tare Sheet: (check one) **Probes** ✓ **47mm Filters**_____ **100mm Filters**_____ **O-Ring Pair**_____

Prepared By: D Davis Balance ID #: Omni-00637 Thermohygrometer ID #: Omni-00592 Audit Weight ID #/Mass: Omni-00283A 1 100g

Placed in Dessicator: Date: 4/12/19 Time: 0955	Date: 4/15/19 Time: 0850 RH %: 8.9 T (°F): 69.2	Date: 4/24/19 Time: 10:36 RH %: 22.2 T (°F): 71.9	Date: 4/25/19 Time: 10:45 RH %: 21.7 T (°F): 71.8	Date: 4/30 Time: 9/30 RH %: 11.1 T (°F): 70.8	Date Used	Project Number	Run No.
ID #	Audit: 99998.0	Audit: 99997.9	Audit: 99997.9	Audit: 99997.8			
2	115016.7	115015.5	115016.3	115016.9			
OES 3	114769.7	114769.2	114769.4 ✓				
4	114858.2	114857.6	114858.1	114857.8 ✓			
8	115594.2	115593.5	115593.6 ✓				
9	115692.3	115692.1	✓				
11	114186.0	114185.5	114185.7 ✓				
13	114322.1	114321.6	114321.7 ✓				
15	114341.7	114341.4	114341.9	114341.7 ✓			
17	114561.2	114560.8	114560.9 ✓				
21	114392.1	114391.5	114392.0	114391.8 ✓			
22	114343.5	114342.8	114343.3	114342.8			
23	114076.7	114076.1	114076.1 ✓		5/28/19 114299.0 ✓	0567WSOOIN	1
25	114299.4	114298.4	114298.3	114298.8			↓
28	114750.4	114749.2	114750.2	114749.7	114749.9 ✓ 5/24/19		2
30	114328.2	114327.6	114327.3 ✓				↓
31	114366.9	114366.5	114366.8	114366.2	114366.4 ✓ 5/30/19		4
32	114741.3	114740.7	114740.9 ✓		5/30/19		↓
33	113943.4	113943.0	113943.2 ✓				
56	118613.2	118613.1 ✓	118613.1 ✓				
7	114981.8	114981.1	114981.5	114981.1			
	Initials: GA	Initials: RDT	Initials: RDT	Initials: RDT	7-1-19		

Final Technician Signature: _____ Date: 4/30/19 Evaluator signature: _____

Tare Sheet: (check one) **Probes**_____ **47mm Filters**_✓_ **100mm Filters**_____ **O-Ring Pair**_____

Prepared By: B Davis Balance ID #: Omni-00637 Thermohygrometer ID #: Omni-00592 Audit Weight ID #/Mass: Omni-00283A / 200 mg

Placed in Dessicator: Date: 3/12/19 Time: 1140 ID #	Date: 3/13/19 Time: 1030 RH %: 16.4 T (°F): 70.9 Audit: 200.1	Date: 3/14/19 Time: 0820 RH %: 10-8 T (°F): 70.7 Audit: 200.1	Date: Time: RH %: T (°F): Audit:	Date: Time: RH %: T (°F): Audit:	Date Used	Project Number	Run No.
T141AP	164.4	164.4			5/28/19	0567WS001N	1
T141BP	164.0	163.9			↓	↓	↓
T142AP	162.8	162.9			↓	↓	2
T142BP	156.7	156.6			↓	↓	2
T143AP	157.1	157.0			5/30/19	↓	4
T143BP	156.3	156.2			↓	↓	↓
T144AP	157.3	157.2					
T144BP	157.4	157.4					
T145AP	158.6	158.7					
T145BP	157.2	157.2					
T146S	78.8	78.8					
T147S	79.3	79.3					
T148S	79.2	79.2					
T149S	78.8	78.9					
T150S	79.3	79.4					
T151S	79.6	79.5					
T152S	79.6	79.6					
T153S	79.2	79.2					
T154S	79.4	79.5					
	Initials: BR	Initials: BR	Initials:	Initials:			

Final Technician Signature: _____ Date: 3/14/19 Evaluator signature: _____

Calibrations

Methods EPA 28R, ASTM E2515, ASTM E3053

ID #	Lab Name/Purpose	Log Name	Attachment Type
132	10 lb Weight	Weight Standard, 10 lb.	Calibration Certificate
16-140TT029	Platform Scale	United 1000 lb.	Calibration Certificate
650	Digital Barometer	Traceable Barometer	Calibration Certificate
283A	Audit Weights	Troemner 21pc Msas Set	Calibration Certificate
371	Sample Box / Dry Gas Meter	Apex Automated Emissions Sampling Box	Calibration Log
372	Sample Box / Dry Gas Meter	Apex Automated Emissions Sampling Box	Calibration Log
410	Microtector	Dwyer Microtector	Calibration Certificate
559	Vaneometer	Dwyer Vaneometer	Equipment Record
592	Thermohygrometer	Omega Digital Thermohygrometer	Calibration Log
594	Combustion Gas Analyzer	CAI Gas Analyzer	See Run Sheet
637	Milligram Balance	Analytical Balance - Mettler - Toledo	Calibration Certificate

SCALE WEIGHT CALIBRATION DATA SHEET

Weight to be calibrated: 10 pounds

ID Number: OMNI-00132

Standard Calibration Weight: 10 pounds

ID Number: OMNI-00255

Scale Used: MTW-150K

ID Number: OMNI-00353

Date: 2/23/2018 By: B. Davis

Standard Weight (A) (Lb.)	Weight Verified (B) (Lb.)	Difference (A - B)	% Error
10.0	10.0	0.0	0

*Acceptable tolerance is 1%.

This calibration is traceable to NIST using calibrated standard weights.

Technician signature: _____ Date: 2/23/18

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

Nelke Consulting LLC
30522 SE Leavenworth Ct.
Eagle Creek, OR 97022

Report Number: NELK0116-1400TT029180418

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Scale	United	1000 lb	16-1400TT029	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
lbs	0.2	QC033	4/18/18	N/A	4/2019

FUNCTIONAL CHECKS

SHIFT TEST		LINEARITY		REPEATABILITY	
Test Wt:	Tol:	Test Wt:	Tol:	Test Wt:	Tol:
250	0.4	HB44	HB44	200	0.2
As-Found:		As-Found:		As-Found:	
Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐
As-Left:		As-Left:		As-Left:	
Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐

CALIBRATION DATA

Standard	As-Found	As-Left
500	500.0	500.0
400	400.1	400.1
300	300.0	300.0
200	200.2	200.2
100	100.1	100.1
50	50.1	50.1

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Avoirdupois Cast W	Rice Lake	25 and 50lb	PWO990-CA	11/24/17	11/2019	20172265

Permanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

Technician: D.Oudeans

Signature: D. Oudeans

Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy.

PT ID: NELK01

Certificate of Calibration

Certificate Number: **698278**

JJ Calibrations, Inc.
7007 SE Lake Rd
Portland, OR 97267-2105
Phone 503.786.3005
FAX 503.786.2994

Omni-Test Laboratories
13327 NE Airport Way
Portland, OR 97230

ACCREDITED
0723.01
Calibration

PO: **190231**
Order Date: 04/04/2019
Authorized By: **N/A**

Property #: OMNI-00650
User: N/A
Department: N/A
Make: Control Company
Model: 6530
Serial #: 181062211
Description: Thermohygrometer / Barometer
Procedure: 403406
Accuracy: ±3%RH, ±.4°C(0.8°F), ±4mbar(0.12inHg)

Calibrated on: 04/18/2019
*Recommended Due: 04/18/2020
Environment: 22 °C 53 % RH
* As Received: Within Tolerance
* As Returned: Within Tolerance
Action Taken: Calibrated
Technician: **146**

Remarks: * Many factors may cause the unit to drift out of calibration before the recommended due date. Any reported error is the absolute value between the reference and the unit. Uncertainties include the effects of the unit.

Standards Used

Std ID	Manufacturer	Model	Nomenclature	Due Date	Trace ID
847A	Fluke	RPM4	Reference Pressure Monitor	11/21/2019	688957
644A	Thunder Scientific	1200	Two Pressure Humidity Generator	07/30/2019	674006

Measurement Data

Parameter / Measurement Description	Range Unit	Reference	Min	Max	kError	UUT	Uncertainty Accredited = ✓
Before/After							
Humidity							
	%	13.0	10	16	1	14 %	5.8E-01 ✓
	%	50.0	47	53	2	48 %	5.8E-01 ✓
	%	80.0	77	83	3	77 %	5.8E-01 ✓
Temperature							
	°C	20.00	19.6	20.4	0.4	19.6 °C	8.1E-02 ✓
	°C	35.00	34.6	35.4	0.4	34.6 °C	8.1E-02 ✓
	°C	50.00	49.6	50.4	0.2	49.8 °C	8.1E-02 ✓
Barometer							
	29 inHg	29.6210	29.501	29.741	0.009	29.630 inHg	8.1E-02 ✓

JJ Calibrations, Inc. certifies that this instrument has been calibrated in accordance with the JJ Calibrations Quality Assurance Manual with the stated procedure using standards that are traceable to the National Institute of Standards and Technology (NIST), or other National Measurement Institutes (NMI's), or by using natural physical constants, intrinsic standards or ratio calibration techniques. The quality system and this certificate are in compliance with ANSI/NCSL Z540-1-1994, ISO/IEC 17025-2005, ISO 10012-1, the ISO 9000 family and QS 9000. The expanded uncertainties of measurements for this calibration are based upon 95% (2 sigma) confidence limits. Unless otherwise stated, a test accuracy ratio (TAR) of 4:1, if achievable, is maintained. The results reported herein apply only to the calibration of the item described above. This report may not be reproduced, except in full, without prior written consent of JJ Calibrations, Inc.
JJ Calibrations, Inc. quality system has been assessed and accredited to ISO/IEC 17025:2005.

Reviewer

3 Issued 04/19/2019 Rev # 15

Inspector

Certificate of Calibration

Certificate Number: **685888**

JJ Calibrations, Inc.
7007 SE Lake Rd
Portland, OR 97267-2105
Phone 503.786.3005
FAX 503.786.2994

Omni-Test Laboratories
13327 NE Airport Way
Portland, OR 97230

A2LA ACCREDITED 0723.01 Calibration

PO: **180188**
Order Date: 10/09/2018
Authorized By: **N/A**

Property #: OMNI-00283A
User: N/A
Department: N/A
Make: Troemner Inc
Model: 1mg-100g (Class F)
Serial #: 47883
Description: Mass Set, 21pc
Procedure: DCN 500901
Accuracy: Class F

Calibrated on: 10/26/2018
*Recommended Due: 10/26/2023
Environment: 20 °C 57 % RH
* As Received: Within Tolerance
* As Returned: Within Tolerance
Action Taken: Calibrated
Technician: **139**

Remarks: * Many factors may cause the unit to drift out of calibration before the recommended due date. Any reported error is the absolute value between the reference and the unit. Uncertainties include the effects of the unit.

This set meets Class F specifications.
Received and returned eight (8) masses in a black case secured by a rubber band.

Standards Used

Std ID	Manufacturer	Model	Nomenclature	Due Date	Trace ID
723A	Rice Lake	1mg-200g (Class 0)	Mass Set,	03/23/2019	668240
800A	Sartorius	MSA225W100DI	Analytical Balance	12/11/2018	663857

Measurement Data

Parameter / Measurement Description	Range Unit	Reference	Min	Max	[k]Error	UUT	Uncertainty Accredited = ✓
Before/After							
Mass							
Dot	200 mg	200.00030	199.4603	200.5403	0.0500	200.0503 mg	6.2E-01 ✓
	1 g	1.00000880	0.9991088	1.0009088	0.0000000	1.0000088 g	1E-03 ✓
	2 g	2.00001470	1.9989147	2.0011147	0.0003250	2.0003397 g	1.3E-03 ✓
	5 g	5.00000840	4.9985084	5.0015084	0.0000400	4.9999684 g	1.7E-03 ✓
	10 g	10.0000100	9.998010	10.002010	0.000245	9.999765 g	2.3E-03 ✓
Dot	20 g	20.0000140	19.996014	20.004014	0.000990	20.001004 g	4.6E-03 ✓
	50 g	49.9999660	49.989966	50.009966	0.000595	49.999371 g	1.1E-02 ✓
	100 g	100.000000	99.98000	100.02000	0.00194	99.99806 g	2.3E-02 ✓

JJ Calibrations, Inc. certifies that this instrument has been calibrated in accordance with the JJ Calibrations Quality Assurance Manual with the stated procedure using standards that are traceable to the National Institute of Standards and Technology (NIST), or other National Measurement Institutes (NMI's), or by using natural physical constants, intrinsic standards or ratio calibration techniques. The quality system and this certificate are in compliance with ANSI/NCSL Z540-1-1994, ISO/IEC 17025-2005, ISO 10012-1, the ISO 9000 family and QS 9000. The expanded uncertainties of measurements for this calibration are based upon 95% (2 sigma) confidence limits. Unless otherwise stated, a test accuracy ratio (TAR) of 4:1, if achievable, is maintained. The results reported herein apply only to the calibration of the item described above. This report may not be reproduced, except in full, without prior written consent of JJ Calibrations, Inc.
JJ Calibrations, Inc. quality system has been assessed and accredited to ISO/IEC 17025:2005.

Reviewer

3 Issued 10/29/2018 Rev # 15

Inspector

Thermal Metering System Calibration
Y Factor

Manufacturer:	Apex
Model:	XC-60-EP
Serial Number:	0702003
OMNI Tracking No.:	OMNI-00371
Calibrated Orifice:	☐ Yes

Average Gas Meter y Factor	Orifice Meter dH@
1.009	N/A

Calibration Date:	01/17/19	
Calibrated by:	B. Davis	
Calibration Frequency:	6 months	
Next Calibration Due:	7/17/2019	
Instrument Range:	1.000	cfm
Standard Temp.:	68	oF
Standard Press.:	29.92	"Hg
Barometric Press., Pb:	29.75	"Hg
Signature/Date:		

Previous Calibration Comparision

		Acceptable Deviation (5%)	Deviation
Date	7/16/2018		
y Factor	0.983	0.04915	0.026
Acceptance	Acceptable		

Current Calibration

Acceptable y Deviation	0.020
Maximum y Deviation	0.009
Acceptable dH@ Deviation	N/A
Maximum dH@ Deviation	N/A
Acceptance	Acceptable

Reference Standard *			
Standard Calibrator	Model	Standard Test Meter	
	S/N	OMNI-00001	
	Calib. Date	18-Nov-18	
	Calib. Value	0.9981	y factor (ref)

Calibration Parameters	Run 1	Run 2	Run 3
Reference Meter Pressure ("H2O), Pr	0.00	0.00	0.00
DGM Pressure ("H2O), Pd	3.24	1.70	1.00
Initial Reference Meter	906.2	914.7	921
Final Reference Meter	914.604	920.9	928.303
Initial DGM	0	0	0
Final DGM	8.126	6.112	7.228
Temp. Ref. Meter (°F), Tr	70.9	69.5	70.0
Temperature DGM (°F), Td	68.0	66.0	70.8
Time (min)	26.0		67.5
Net Volume Ref. Meter, Vr	8.404	6.200	7.303
Net Volume DGM, Vd	8.126	6.112	7.228
Gas Meter y Factor =	**1.018**	**1.002**	**1.008**
Gas Meter y Factor Deviation (from avg.)	0.009	0.008	0.002
Orifice dH@	**N/A**	**N/A**	**N/A**
Orifice dH@ Deviation (from avg.)	N/A	N/A	N/A

where:

1. Deviation = |Average value for all runs - current run value|

** 2. y = [Vr x (y factor (ref)) x (Pb + (Pr/ 13.6)) x (Td + 460)]/ [Vd x (Pb + (Pd / 13.6)) x (Tr + 460)]

** 3. dH@ = 0.0317 x Pd / (Pb (Td + 460)) x [(Tr + 460) x time) / Vr]^2

* Reference calibration is traceable to NIST through NIST Test # 40674, Kimble ASTM E1272, or NIST traceable laboratory

** Equations come from EPA Method 5

The uncertainty of measurement is ±0.14 ft^3/min. This is based on the reference standard having a TAR (Test Accuracy Ratio) of at least 4:1.

Temperature Calibration
EPA Method 28R, ASTM 2515

Booth:	Temperature Monitor Type:	Equipment Number:
Mobile	National Instruments Logger	00371, 00372

Reference Meter Equipment Number: 00373	Calibration Due Date: 7/21/19

Performed By:	Date:	Ambient Temperature:	Barometric Pressure:
A. Kravitz	1/121/2019	68	30.27

Input (F)	Amb	Meter A	Meter B	Filter A	Filter B	Tunnel	FB Interior
0	-1	-1	-1	-1	-1	-1	-1
100	99	99	99	99	99	99	99
300	299	299	299	300	299	299	299
500	499	499	499	499	499	499	499
700	699	699	699	699	699	699	699
1000	999	999	999	999	999	999	999

Input (F)	FB Top	Bottom	Back	Left	Right	Imp A	Imp B	Cat	Stack
0	0	0	-1	-1	-1	-1	-1	-1	-1
100	99	99	99	99	99	99	100	99	99
300	299	299	299	299	299	299	299	299	299
500	499	499	499	499	499	499	499	499	499
700	699	699	699	699	699	699	699	699	699
1000	999	999	999	999	999	999	999	999	999

1200 ——— 1249
1600 ——— 1599
2000 ——— 1999

Technician signature: _____ Date: 1/21/2019

Reviewed By: _____ Date: 2/25/19

DIFFERENTIAL PRESSURE GAUGE CALIBRATION DATA SHEET

Instrument to be calibrated: 371B

Maximum Range: 1" H2O ID Number: 371B

Calibration Instrument: Digital Manometer ID Number: 633

Date: 1/21/2019 By: Aaron Kravitz

This form is to be used only in conjunction with Standard Procedure C-SPC.

Range of Calibration Point ("WC)	Digital Manometer Input ("WC)	Pressure Gauge Response ("WC)	Difference (Input - Response)	% Error of Full Span*
0-20% Max. Range	0.12	0.13	0.01	1%
20-40% Max. Range	0.38	0.36	0.02	2%
40-60% Max. Range	0.44	0.45	0.01	1%
60-80% Max. Range	0.61	0.60	0.01	1%
80-100% Max. Range	0.48	0.49	0.01	1%

*Acceptable tolerance is 4%.

The uncertainty of measurement is ±0.4" WC. This is based on the reference standard having a TAR (Test Accuracy Ratio) of at least 4:1.

Technician signature: _____ Date: 1/21/19

Reviewed by: _____ Date: 2/25/19

Thermal Metering System Calibration
Y Factor

Manufacturer:	Apex
Model:	XC-60-EP
Serial Number:	0702004
OMNI Tracking No.:	OMNI-00372
Calibrated Orifice:	☐ Yes

Average Gas Meter y Factor	Orifice Meter dH@
0.996	N/A

Calibration Date:	01/17/19	
Calibrated by:	B. Davis	
Calibration Frequency:	6 months	
Next Calibration Due:	7/17/2019	
Instrument Range:	1.000	cfm
Standard Temp.:	68	oF
Standard Press.:	29.92	"Hg
Barometric Press., Pb:	30.24	"Hg
Signature/Date:		

Previous Calibration Comparision

		Acceptable Deviation (5%)	Deviation
Date	7/16/2018		
y Factor	0.993	0.04965	0.003
Acceptance	Acceptable		

Current Calibration

Acceptable y Deviation	0.020
Maximum y Deviation	0.014
Acceptable dH@ Deviation	N/A
Maximum dH@ Deviation	N/A
Acceptance	Acceptable

Reference Standard *			
Standard Calibrator	Model	Standard Test Meter	
	S/N	OMNI-00001	
	Calib. Date	14-Nov-18	
	Calib. Value	0.9981	y factor (ref)

Calibration Parameters	Run 1	Run 2	Run 3
Reference Meter Pressure ("H2O), Pr	0.00	0.00	0.00
DGM Pressure ("H2O), Pd	2.00	1.30	0.80
Initial Reference Meter	963.421	968.575	973.96
Final Reference Meter	968.575	973.968	979.252
Initial DGM	0	0	0
Final DGM	5.164	5.336	5.384
Temp. Ref. Meter (°F), Tr	65.3	65.5	66.5
Temperature DGM (°F), Td	67.0	68.0	69.0
Time (min)	27.8	36.5	48.3
Net Volume Ref. Meter, Vr	5.154	5.393	5.292
Net Volume DGM, Vd	5.164	5.336	5.384
Gas Meter y Factor =	**0.995**	**1.010**	**0.984**
Gas Meter y Factor Deviation (from avg.)	0.002	0.014	0.012
Orifice dH@	**N/A**	**N/A**	**N/A**
Orifice dH@ Deviation (from avg.)	N/A	N/A	N/A

where:

1. Deviation = |Average value for all runs - current run value|

** 2. y = [Vr x (y factor (ref)) x (Pb + (Pr/ 13.6)) x (Td + 460)]/ [Vd x (Pb + (Pd / 13.6)) x (Tr + 460)]

** 3. dH@ = 0.0317 x Pd / (Pb (Td + 460)) x [(Tr + 460) x time) / Vr]^2

* Reference calibration is traceable to NIST through NIST Test # 40674, Kimble ASTM E1272, or NIST traceable laboratory

** Equations come from EPA Method 5

The uncertainty of measurement is ±0.14 ft^3/min. This is based on the reference standard having a TAR (Test Accuracy Ratio) of at least 4:1.

Temperature Calibration
EPA Method 28R, ASTM 2515

Booth:	Temperature Monitor Type:	Equipment Number:
Mobile	National Instruments Logger	00371, 00372

Reference Meter Equipment Number: 00373	Calibration Due Date: 7/21/19

Performed By:	Date:	Ambient Temperature:	Barometric Pressure:
A. Kravitz	1/121/2019	68	30.27

Input (F)	Amb	Meter A	Meter B	Filter A	Filter B	Tunnel	FB Interior
0	-1	-1	-1	-1	-1	-1	-1
100	99	99	99	99	99	99	99
300	299	299	299	300	299	299	299
500	499	499	499	499	499	499	499
700	699	699	699	699	699	699	699
1000	999	999	999	999	999	999	999

Input (F)	FB Top	Bottom	Back	Left	Right	Imp A	Imp B	Cat	Stack
0	0	0	-1	-1	-1	-1	-1	-1	-1
100	99	99	99	99	99	99	100	99	99
300	299	299	299	299	299	299	299	299	299
500	499	499	499	499	499	499	499	499	499
700	699	699	699	699	699	699	699	699	699
1000	999	999	999	999	999	999	999	999	999

1200 ——— 1249
1600 ——— 1599
2000 ——— 1999

Technician signature: _____ Date: 1/21/2019

Reviewed By: _____ Date: 2/25/19

DIFFERENTIAL PRESSURE GAUGE CALIBRATION DATA SHEET

Instrument to be calibrated: 372B

Maximum Range: 1" H_2O ID Number: 372B

Calibration Instrument: Digital Manometer ID Number: 633

Date: 1/21/2019 By: Aaron Kravitz

This form is to be used only in conjunction with Standard Procedure C-SPC.

Range of Calibration Point ("WC)	Digital Manometer Input ("WC)	Pressure Gauge Response ("WC)	Difference (Input - Response)	% Error of Full Span*
0-20% Max. Range	0.14	0.15	0.01	1%
20-40% Max. Range	0.37	0.38	0.01	1%
40-60% Max. Range	0.54	0.56	0.02	2%
60-80% Max. Range	0.62	0.63	0.01	1%
80-100% Max. Range	0.94	0.96	0.02	2%

*Acceptable tolerance is 4%.

The uncertainty of measurement is ±0.4" WC. This is based on the reference standard having a TAR (Test Accuracy Ratio) of at least 4:1.

Technician signature: _____ Date: 1/21/19

Reviewed by: _____ Date: 2/25/19

Certificate of Calibration

Certificate Number: **686722**

JJ Calibrations, Inc.
7007 SE Lake Rd
Portland, OR 97267-2105
Phone 503.786.3005
FAX 503.786.2994

Omni-Test Laboratories
13327 NE Airport Way
Portland, OR 97230

ACCREDITED
0723.01
Calibration

PO: **180192**
Order Date: 10/22/2018
Authorized By: **N/A**

Property #: OMNI-00410
User: N/A
Department: N/A
Make: Dwyer
Model: 1430
Serial #: OMNI-00410
Description: Microtector
Procedure: DCN 500908
Accuracy: ±0.00025" WC

Calibrated on: 10/30/2018
*Recommended Due: 10/30/2019
Environment: 22 °C 44 % RH
* As Received: Limited
* As Returned: Limited
Action Taken: Calibrated
Technician: **111**

Remarks: * Many factors may cause the unit to drift out of calibration before the recommended due date. Any reported error is the absolute value between the reference and the unit. Uncertainties include the effects of the unit.

Previous limitation of micrometer head calibrated only continued. .001" reading micrometer head ±.001" (LSD) tolerance applied.

Standards Used

Std ID	Manufacturer	Model	Nomenclature	Due Date	Trace ID
541A	Select	E8FED2	Gage Block Set, 8pc	12/18/2018	663864

Measurement Data

Parameter / Measurement Description	Range Unit	Reference	Min	Max	ᵏError	UUT	Uncertainty Accredited = ✓
Before/After							
Length							
	Inch	0.1300	0.129	0.131	0.001	0.129 Inch	1.1E-03 ✓
	Inch	0.3850	0.384	0.386	0.001	0.384 Inch	1.1E-03 ✓
	Inch	0.6150	0.614	0.616	0.001	0.614 Inch	1.1E-03 ✓
	Inch	0.8700	0.869	0.871	0.001	0.869 Inch	1.1E-03 ✓
	Inch	1.0000	0.999	1.001	0.001	0.999 Inch	1.1E-03 ✓

Reviewer

3 Issued 10/31/2018 Rev # 15

Inspector

Calibration Record

Vaneometer Air Velocity Meter OMNI-00559

Calibration Service Record			
Date	**By**	**Results**	**Date of next Calibration**
11/17/17	BR	Installed New Vane From Manufacturer	5/17/18
7/12/18	BR	Installed New Vane from Manufacturer	1/12/19
6/13/19	BR	Installed New Vane From Manufacture	6/15/19

VWR Temperature Hygrometer Calibration Procedure and Data Sheet

Frequency: Every Two Years

Step 1: Locate NIST traceable standard.

Step 2: Place unit to be calibrated, tracking No. OMNI-00592, inside OMNI desiccate box on the same shelf with the NIST traceable standard.

Step 3: After a period of not less than four hours record the temperature and humidity of both units in the spaces provide below.

Step 4: If the unit to be calibrated matches the NIST standard within ± 4%, it is acceptable. If not, the unit needs to be sent to a repair company or replaced.

Verification Data:

Date: 1/29/19 ~~1/29/19~~ BD Technician: B Davis

Time in desiccate: 0840 Recording time: 1415

NIST Standard Temperature: 70.2 °F NIST Standard Humidity: 14.6

Test Unit Temperature Reading: 69.9 °F Test Unit Humidity Reading: 12.1

Test unit OMNI- 00592 is X or was not ___ within acceptable limits.

Technician Signature: BD

Comments: A difference of 2.5% was found, with a full scale of 90% on the Instrument this gives a 2.77% deviation.

ZRE NDIR/O_2

USER'S MANUAL

1312 West Grove Avenue
Orange, CA 92865-4134
Phone: 714-974-5560 Fax: 714-921-2531
www.gasanalyzers.com

Certificate of Calibration

Certificate Number: **692254**

JJ Calibrations, Inc.
7007 SE Lake Rd
Portland, OR 97267-2105
Phone 503.786.3005
FAX 503.786.2994

Omni-Test Laboratories
13327 NE Airport Way
Portland, OR 97230

OnSite

ACCREDITED
0723.01
Calibration

PO: **181203**
Order Date: **01/11/2019**
Authorized By: **N/A**

Property #: **OMNI-00637**
User: **N/A**
Department: **N/A**
Make: **Mettler Toledo**
Model: **MS104TS/00**
Serial #: **B729400181**
Description: **Analytical Scale, 120g**
Procedure: **DCN 500887**
Accuracy: **±0.0005g**

Calibrated on: **01/11/2019**
*Recommended Due: **07/11/2019**
Environment: **19** °C **43** % RH
* As Received: **Within Tolerance**
* As Returned: **Within Tolerance**
Action Taken: **Calibrated**
Technician: **123**

Remarks: * Many factors may cause the unit to drift out of calibration before the recommended due date. Any reported error is the absolute value between the reference and the unit. Uncertainties include the effects of the unit.

Standards Used

Std ID	Manufacturer	Model	Nomenclature	Due Date	Trace ID
256A	Rice Lake	W0133K	Mass Set,	05/30/2019	660578

Measurement Data

Parameter / Measurement Description	Range	Unit	Reference	Min	Max	*Error	UUT	Uncertainty
Before/After								Accredited = ü
Force								
		g	10.00000	9.9995	10.0005	0.0000	10.0000 g	5.7E-04 ü
		g	30.00000	29.9995	30.0005	0.0000	30.0000 g	5.7E-04 ü
		g	60.00000	59.9995	60.0005	0.0002	59.9998 g	5.7E-04 ü
		g	90.00000	89.9995	90.0005	0.0001	89.9999 g	5.7E-04 ü
		g	120.00000	119.9995	120.0005	0.0002	119.9998 g	5.7E-04 ü

Reviewer

3 Issued 01/14/2019 Rev # 15

Inspector

Example Calculations

Equations and Sample Calculations – ASTM E2780 & E2515

Manufacturer:	New Buck Stoves
Model:	91
Run:	2
Category:	I

Equations used to calculate the parameters listed below are described in this appendix. Sample calculations are provided for each equation. The raw data and printout results from a sample run are also provided for comparison to the sample calculations.

M_{Sdb} – Weight of test fuel spacers, dry basis, kg

M_{Cdb}– Weight of test fuel crib, excluding nails and spacers, dry basis, kg

D_{Cdb} - Density of fuel crib, excluding spacers and nails, dry basis, lbs/ft^3

M_{FTAdb} - Total weight of fuel crib excluding nails, dry basis, kg

BR – Dry burn rate, kg/hr

V_s – Average gas velocity in the dilution tunnel, ft/sec

Q_{sd} – Average gas flow rate in dilution tunnel, dscf/hr

$V_{m(std)}$ – Volume of gas sampled, corrected to dry standard conditions, dscf

m_n – Total particulate matter collected, mg

C_s - Concentration of particulate matter in tunnel gas, dry basis, corrected to standard conditions, g/dscf

E_T – Total particulate emissions, g

PR - Proportional rate variation

PM_R – Particulate emissions for test run, g/hr

PM_F – Particulate emission factor for test run, g/dry kg of fuel burned

BR – dry burn rate, kg/hr
ASTM E2780 equation (5)

$$BR = \frac{60\ M_{FTAdb}}{\theta}$$

Where,

θ = Total length of test run, min

Sample Calculation:

M_{Bdb} = 11.02 kg

θ = 1230 min

$$BR = \frac{60 \times 11}{1230}$$

BR = **0.54** kg/hr

V_s – Average gas velocity in the dilution tunnel, ft/sec
ASTM E2515 equations (9)

$$v_s = F_P \times k_p \times C_p \times (\sqrt{\Delta P})_{avg} \times \sqrt{\frac{T_{s(avg)}}{P_s \times M_s}}$$

Where:

F_p = Adjustment factor for center of tunnel pitot tube placement, $Fp = \frac{V_{strav}}{V_{scent}}$, ASTM E2515 Equation (1)

v_{scent} = Dilution tunnel velocity calculated after the multi-point pitot traverse at the center, ft/sec

v_{strav} = Dilution tunnel velocity calculated after the multi-point pitot traverse, ft/sec

k_p = Pitot tube constant, 85.49

C_p = Pitot tube coefficient: 0.99, unitless

ΔP* = Velocity pressure in the dilution tunnel, in H_2O

T_s = Absolute average gas temperature in the dilution tunnel, °R; (°R = °F + 460)

P_s = Absolute average gas static pressure in dilution tunnel, = $P_{bar} + P_g$, in Hg

P_{bar} = Barometric pressure at test site, in. Hg

P_g = Static pressure of tunnel, in. H_20; (in Hg = in H_20/13.6)

M_s = **The dilution tunnel wet molecular weight; M_s = 28.78 assuming a dry weight of 29 lb/lb-mole

Sample calculation:

$$Fp = \frac{19.12}{20.44} = 0.935$$

$$V_s = 0.935 \times 85.49 \times 0.99 \times 0.300 \times \left(\frac{77.3 + 460}{\left(29.42 + \frac{-0.23}{13.6}\right) \times 28.78} \right)^{1/2}$$

V_s = **18.91** ft/s

*The ASTM test standard mistakenly has the square root of the average delta p instead of the average of the square root of delta p. The current EPA Method 2 is also incorrect. This was verified by Mike Toney at EPA.

**The ASTM test standard mistakenly identifies Ms as the dry molecular weight. It should be the wet molecular weight as indicated in EPA Method 2.

Q_{sd} – Average gas flow rate in dilution tunnel, dscf/hr
ASTM E2515 equation (3)

$$Q_{sd} = 3600 \times (1 - B_{ws}) \times v_s \times A \times \frac{T_{std}}{T_{s(avg)}} \times \frac{P_s}{P_{std}}$$

Where:

3600	=	Conversion from seconds to hours (ASTM method uses 60 to convert in minutes)
B_{ws}	=	Water vapor in gas stream, proportion by volume; assume 2%
A	=	Cross sectional area of dilution tunnel, ft^2
T_{std}	=	Standard absolute temperature, 528 °R
P_s	=	Absolute average gas static pressure in dilution tunnel, = P_{bar} + P_g , in Hg
$T_{s(avg)}$	=	Absolute average gas temperature in the dilution tunnel, °R; (°R = °F + 460)
P_{std}	=	Standard absolute pressure, 29.92 in Hg

Sample calculation:

$$Q_{sd} = 3600 \times (1 - 0.02) \times 18.91 \times 0.196 \times \frac{528}{77.3 + 460} \times \frac{29.4 + \frac{-0.23}{13.6}}{29.92}$$

Q_{sd} = **12648.6** dscf/hr

$V_{m(std)}$ – Volume of Gas Sampled Corrected to Dry Standard Conditions, dscf
ASTM E2515 equation (6)

$$V_{m(std)} = K_1 \, V_m \, Y \frac{P_{bar} + \left(\frac{\Delta H}{13.6}\right)}{T_m}$$

Where:

K_1	=	17.64 °R/in. Hg
V_m	=	Volume of gas sample measured at the dry gas meter, dcf
Y	=	Dry gas meter calibration factor, dimensionless
P_{bar}	=	Barometric pressure at the testing site, in. Hg
ΔH	=	Average pressure differential across the orifice meter, in. H_2O
T_m	=	Absolute average dry gas meter temperature, °R

Sample Calculation:

Using equation for Train 1:

$$V_{m(std)} = 17.64 \times 200.629 \times 1.009 \times \frac{\left(29.42 + \frac{2.21}{13.6}\right)}{(78.6 + 460)}$$

$V_{m(std)}$ = **196.132** dscf

Using equation for Train 2:

$$V_{m(std)} = 17.64 \times 216.756 \times 0.996 \times \frac{\left(29.42 + \frac{1.79}{13.6}\right)}{(77.1 + 460)}$$

$V_{m(std)}$ = **209.551** dscf

Using equation for ambient train:

$$V_{m(std)} = 17.64 \times 0.00 \times 0 \times \frac{\left(\underline{29.42} + \frac{0.00}{13.6}\right)}{(72.9 + 460)}$$

$V_{m(std)}$ = **0** dscf

m_n – Total Particulate Matter Collected, mg
ASTM E2515 Equation (12)

$$m_n = m_p + m_f + m_g$$

Where:

m_p = mass of particulate matter from probe, mg

m_f = mass of particulate matter from filters, mg

m_g = mass of particulate matter from filter seals, mg

Sample Calculation:

Using equation for Train 1 (first hour):

m_n = 0.0 + 1.8 + 0.0

m_n = 1.8 mg

Using equation for Train 1 (post-first hour):

m_n = 0.9 + 1.9 + 2.4

m_n = 5.2 mg

Train 1 aggregate:

m_n = 1.8 + 5.2

m_n = **7.0** mg

Using equation for Train 2:

m_n = 1 + 1.8 + 4.8

m_n = **7.6** mg

C_s - Concentration of particulate matter in tunnel gas, dry basis, corrected to standard conditions, g/dsc
ASTM E2515 equation (13)

$$C_s = K_2 \times \frac{m_n}{V_{m(std)}}$$

Where:

K_2	=	Constant, 0.001 g/mg
m_n	=	Total mass of particulate matter collected in the sampling train, mg
$V_{m(std)}$	=	Volume of gas sampled corrected to dry standard conditions, dscf

Sample calculation:

For Train 1:

$$C_s = 0.001 \times \frac{7.0}{196.13}$$

C_s = **0.00004** g/dscf

For Train 2

$$C_s = 0.001 \times \frac{7.6}{209.55}$$

C_s = **0.00004** g/dscf

For Ambient Train

$$C_r = 0.001 \times \frac{0.0}{0}$$

C_r = **0** g/dscf

E_T – Total Particulate Emissions, g
ASTM E2515 equation (15)

$$E_T = (c_s - c_r) \times Q_{std} \times \theta$$

Where:

C_s	=	Concentration of particulate matter in tunnel gas, g/dscf
C_r	=	Concentration particulate matter room air, g/dscf
Q_{std}	=	Average dilution tunnel gas flow rate, dscf/hr
θ	=	Total time of test run, minutes

Sample calculation:

For Train 1

E_T = (0.000036 - 0) x ###### x 1230 /60

E_T = 9.25 g

For Train 2

E_T = (0.000036 - 0) x ###### x 1230 /60

E_T = 9.40 g

Average

E = 9.33 g

Total emission values shall not differ by more than 7.5% from the total average emissions

7.5% of the average =	0.70
Train 1 difference =	0.07
Train 2 difference =	0.07

PR - Proportional Rate Variation
ASTM E2515 equation (16)

$$PR = \left[\frac{\theta \times V_{mi} \times V_s \times T_m \times T_{si}}{\theta_i \times V_m \times V_{si} \times T_{mi} \times T_s} \right] \times 100$$

Where:

θ = Total sampling time, min

θ_i = Length of recording interval, min

V_{mi} = Volume of gas sample measured by the dry gas meter during the “ith” time interval, dcf

V_m = Volume of gas sample as measured by dry gas meter, dcf

V_{si} = Average gas velocity in the dilution tunnel during the "ith" time interval, ft/sec

V_s = Average gas velocity in the dilution tunnel, ft/sec

T_{mi} = Absolute average dry gas meter temperature during the "ith" time interval, ^oR

T_m = Absolute average dry gas meter temperature, ^oR

T_{si} = Absolute average gas temperature in the dilution tunnel during the "ith" time interval, ^oR

T_s = Absolute average gas temperature in the dilution tunnel, ^oR

Sample calculation (for the first 1 minute interval of Train 1):

$$PR = \left(\frac{\#\#\# \times 1.614 \times 18.91 \times (128.0 + 460) \times (78.6 + 460)}{10 \times 200.6 \times 18.67 \times (77.3 + 460) \times (83.0 + 460)} \right) \times 100$$

PR = 109 %

PM_R – Particulate emissions for test run, g/hr
ASTM E2780 equation (6)

$$PM_R = 60 (E_T/\theta)$$

Where,

E_T = Total particulate emissions, grams

Sample Calculation:

E_T (Dual train average) = 9.33 g

θ = 1230 min

$PM_R = 60 \times (9.33 / 1230)$

PM_R = **0.46** g/hr

PM_F – Particulate emission factor for test run, g/dry kg of fuel burned
ASTM E2780 equation (7)

$$PM_F = E_T/M_{FTAdb}$$

Sample Calculation:

E_T (Dual train average) = 9.33 g

M_{Bdb} = 11.02 kg

PM_F = 9.33 / 11.02

PM_F = **0.85** g/kg

Appendix A
Manufacturer's Installation/Operation Instructions - Labels

REVISED 7-8-19 **CHG**
LISTED SOLID FUEL BURNING ROOM HEATER MASONRY / FIREPLACE -TO- LISTED FACTORY BUILT OR MASONRY FIREPLACE ACCESSORY/INSERT ROOM HEATERS, SOLID FUEL

REVISED 7-8-19 **CHG**
INTERTEK LOGO TO PFS

CONTACT YOUR LOCAL BUILDING OR FIRE OFFICIALS ABOUT RESTRICTIONS AND INSTALLATION INSPECTION IN YOUR AREA

LISTED FACTORY BUILT OR MASONRY FIREPLACE ACCESSORY/INSERT ROOM HEATERS, SOLID FUEL TYPE

Manufactured by
NEW BUCK CORPORATION
P.O. BOX 69
Spruce Pine, NC 29777

REVISED : 7,8,19
REMOVED SLASH (/) FROM IN BETWEEN NEW BUCK AND CAROLINA.

CHG NEW BUCK CAROLINA -TO- NEW BUCK CORPORATION

SERIAL NO.

MODEL: 91 BAY
TESTED TO: UL 737, 1482
TEST DATE: JULY , 1991
REPORT NO. 91-014
TYPE OF FUEL: Wood Fuel Only

ELECTRICAL RATING:
115 VAC 1.2 amps 60Hz
Motor: PE910714

DANGER: Risk of electrical shock.

Disconnect power before servicing unit.

Do not route power cord beneath heater.

"Do Not Use Grate or Elevate Fire – Build Wood Fire Directly on Hearth."

PREVENT HOUSE FIRES

Install and use only in accordance with Manufacturer's installation and operating instructions and your local building codes.

CAUTION: Special methods are required when passing chimney through a wall or ceiling, refer to local building codes. Do not pass chimney connector through a Combustible surface. Do not connect this unit to a chimney flue serving another Appliance.

Note: Replace glass only with Part # PG265191GL.

Use only a lined masonry or listed Type HT factory-built chimney.

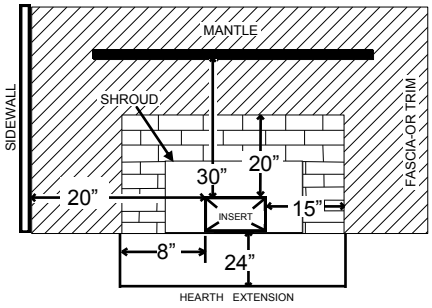
"Do Not Overfire– If Heater or Chimney Connector Glows, You Are Overfiring."

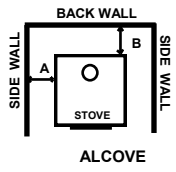
Install insert with a minimum of 20" clearance to combustible sidewall, 15" to side trim and 20" to top trim, 30" from top of insert to mantel or mantel supports. Floor protector must be 3/8" minimum non-combustible material or equivalent, extending 24" from front opening and 8" to both front side of unit. When used as an insert stove, install only in a masonry fireplace, built to UBC Chapter 37. See owners manual for instruction for masonry insert installation. Do not remove brick or mortar from masonry fireplace to accommodate insert. See instruction manual for masonry insert flue connection options.

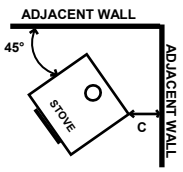
Remove and clean behind unit frequently, as creosote buildup may occur rapidly.

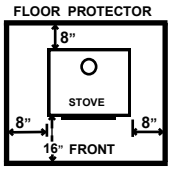
"Inspect and Clean Chimney Frequently-Under Certain Conditions of Use, Creosote Buildup may Occur Rapidly."

Minimum clearances to Combustible Materials (in inches)









For freestanding installation, 3/8" minimum thickness non-combustible floor protection with an insulation R-Value of 1.1. must be used under the appliance, 16" beyond the front of the fuel door and 8" to each side of unit as indicated.

Installation	Clearance	Chimney & Connector	Dimensions A	B	C
Residential	Standard	Note: 1	24	23	16
Residential	Standard	Note: 2	14	14	12

Note 1 : 8" inch diameter, single wall, minimum 24 MSG black or 24 NSG blued steel chimney connector pipe with a listed factory - built Class "A" chimney or masonry chimney.

Note 2 : 8" inch diameter double walled connector pipe with a listed factory - built Class "A" chimney or masonry chimney.

⁎ Horizontal connector not permitted.

CATALYTIC CONNECTOR: Applied Ceramics, Inc., Part No. ACI-22C
The burning of metal foils, coal, plastic and garbage, sulphur and diesel oil will make the catalyst in the converter inactive. The converter is fragile: handle carefully. Neither the performance of the catalytic device nor its durability has been evaluated as part of the certification procedure.

ADHESIVE LABEL
BLACK LETTERING ON SILVER
MDL. 91 LABEL– ON BACK OF STOVE

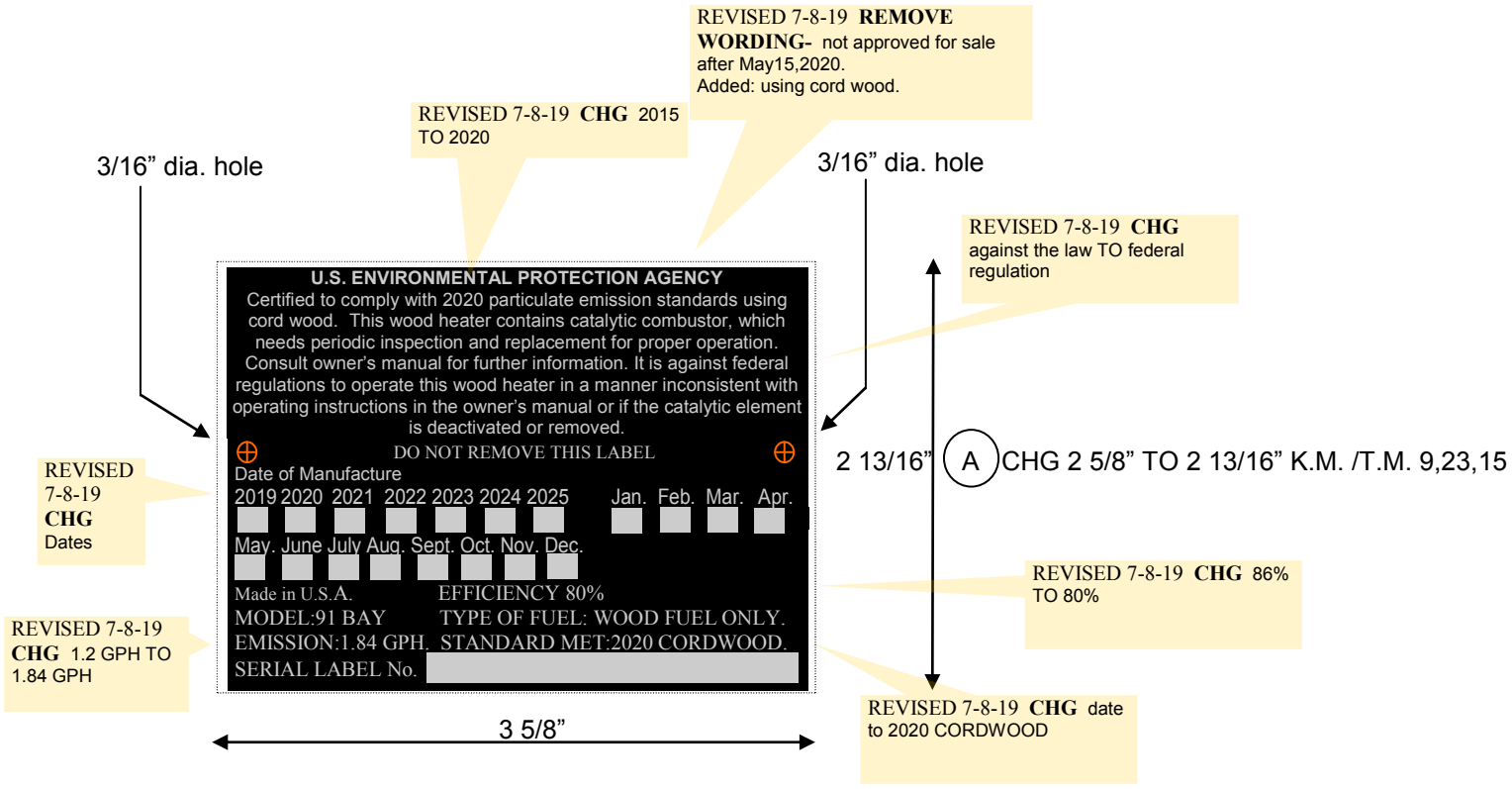
MODEL 91

ADHESIVE LABEL

SILVER LETTERING ON BLACK

LEFT HEARTH SUPPORT

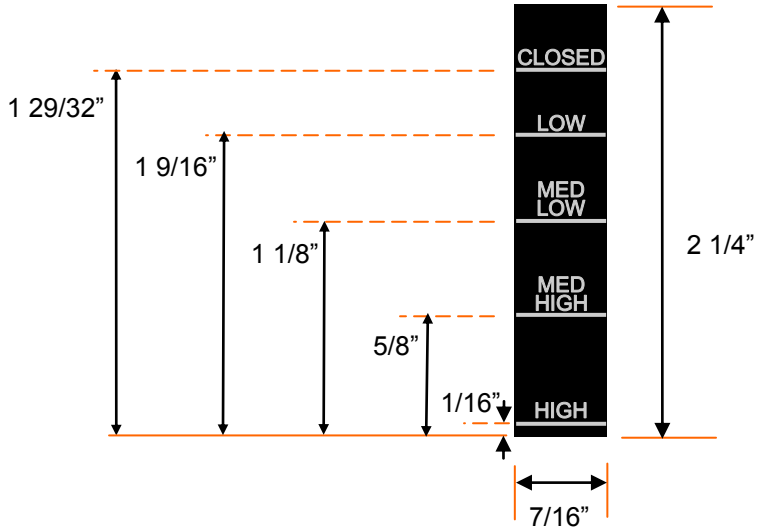
EPA LABEL



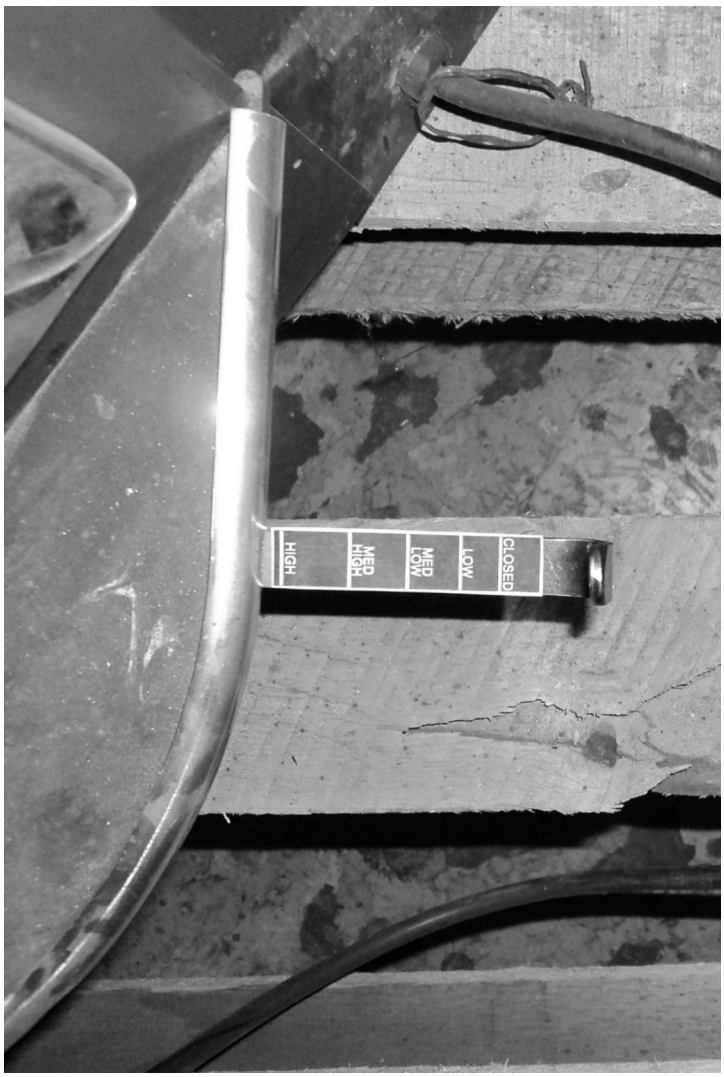
ADHESIVE BACKING

SILVER LETTERING ON BLACK– (5)SILVER LINES

91 PRIMARY AIR CONTROL ROD DRAFT INDICATOR



PULL AIR CONTROLL ROD ALL WAY OUT. **LOOKING DOWN** PLACE INDICATOR LABEL WITH WORDING “**HIGH**” EVEN WITH OUTSIDE HEARTH TRIM.



FACING UINT

RIGHT SIDE CONTROL LABEL

Manufactured by NEW BUCK CORPORATION Model 91

U. S. ENVIRONMENTAL PROTECTION AGENCY

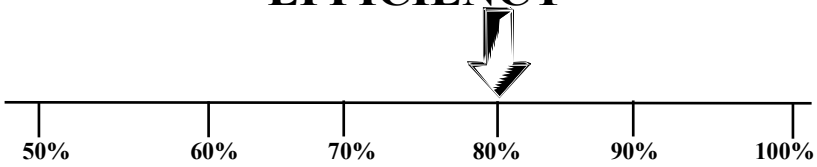
CATALYST

MEETS EPA PARTICULATE MATTER (Smoke) CONTROL REQUIREMENTS FOR CATALYTIC WOOD HEATERS BUILT ON OR AFTER MAY 15, 2020. SEE CATALYST WARRANTY. ILLEGAL TO OPERATE WHEN CATALYST IS NOT WORKING SEE OWNERS MANUAL FOR OPERATION AND MAINTENANCE.

SMOKE

This Model

E.P.A. EFFICIENCY



Wood heaters with higher efficiencies cost less to operate.

HEAT OUTPUT
8,500 TO 62,745 BTU/HR

Use this to choose the right size appliance for your needs.
ASK DEALER FOR HELP.
This wood heater will achieve low smoke output and high efficiency if properly operated and maintianed. See owners manual.

Manufactured by NEW BUCK CORPORATION Model 91

U. S. ENVIRONMENTAL PROTECTION AGENCY

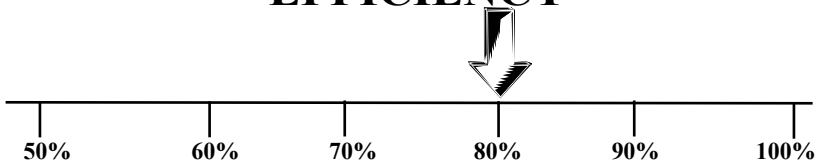
CATALYST

MEETS EPA PARTICULATE MATTER (Smoke) CONTROL REQUIREMENTS FOR CATALYTIC WOOD HEATERS BUILT ON OR AFTER MAY 15, 2020. SEE CATALYST WARRANTY. ILLEGAL TO OPERATE WHEN CATALYST IS NOT WORKING SEE OWNERS MANUAL FOR OPERATION AND MAINTENANCE.

SMOKE

This Model

E.P.A. EFFICIENCY

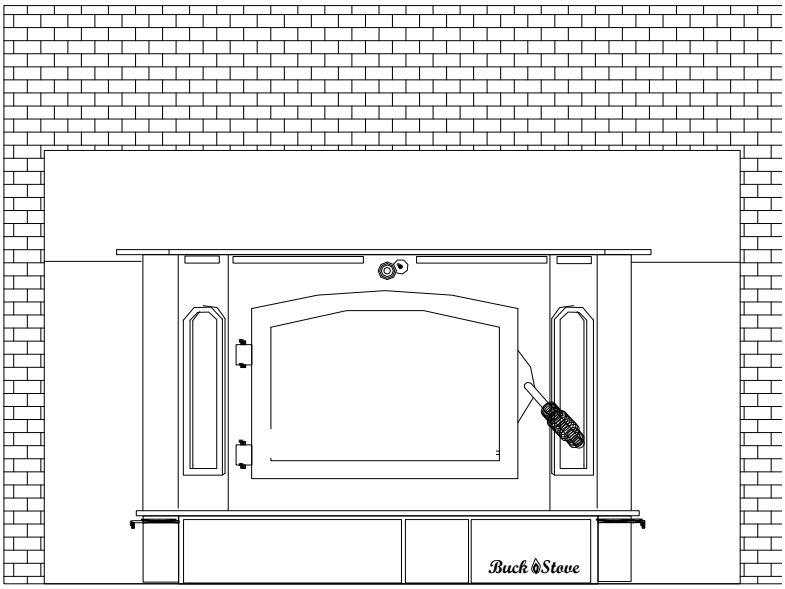


Wood heaters with higher efficiencies cost less to operate.

HEAT OUTPUT
8,500 TO 62,745 BTU/HR

Use this to choose the right size appliance for your needs.
ASK DEALER FOR HELP.
This wood heater will achieve low smoke output and high efficiency if properly operated and maintianed. See owners manual.

MODEL 91
CATALYTIC UNIT



FIREPLACE INSERT & FREESTANDING

FEATURES
PREPARATIONS INSTALLATION
OPERATION MAINTENANCE SAFETY

SAFETY NOTICE ⚠

IF THIS HEATER IS NOT PROPERLY INSTALLED, A HOUSE FIRE MAY RESULT. FOR YOUR SAFETY, FOLLOW THE INSTALLATION INSTRUCTIONS. CONTACT THE AUTHORITY HAVING JURISDICTION (SUCH AS MUNICIPAL BUILDING DEPARTMENT, FIRE DEPARTMENT, FIRE PREVENTION BUREAU, etc.) CONSULT BEFORE INSTALLATION TO DETERMINE THE NEED TO OBTAIN A PERMIT. KEEP THESE INSTRUCTIONS FOR FUTURE USE.

LISTED BY: PFS US **PFS/TECO, COTTAGE GROVE, WI**

MANUFACTURED BY NEW BUCK CORPORATION
200 ETHAN ALLEN DRIVE,
SPRUCE PINE, N.C. 28777
www.buckstove.com
Revised July 2019

TABLE OF CONTENTS

SECTION I

When installed and operated as specified in these instructions, and as stipulated on operation and installation labels affixed to unit, **The New Buck Corporation** room heater Model 91 Bay is one of the safest and most efficient heating systems available. The unit is designed to burn wood fuel only.

Please read this entire manual before you install and use your new room heater. Failure to follow instructions may result in property damage, bodily injury or even death.

- **NOTE: When burning any unit or appliance that combusts fuel for heat, we highly recommend use of smoke and carbon monoxide detectors in your home.**

Early signs of carbon monoxide poisoning resemble flu, with headaches, dizziness and/or nausea. If you have these signs, heater may not be working properly. Get fresh air at once!

Throughout manual, you will see this ⚠ symbol. This indicates areas of importance regarding safety. Please make a special note of these areas.

Install and use only in accordance with manufacturer's installation and operating instructions. Do not connect this unit to a chimney flue serving another appliance. This unit is not designed for installation in a mobile home.

ROOM HEATER FEATURES

Before attempting to install or operate your heater, it is a good idea to familiarize yourself with features and operating controls of unit. (See page 4 for reference).

OPERATING CONTROLS

⚠ **WARNING:** Model 91 Bay Heater was not designed for fire grates.
NOTE: Do not use grate, elevate fire or build wood fire directly on hearth.

1. **Bypass Damper:** The bypass damper control is located in top center of heater front just under top. It is operated by pushing or pulling rod. The damper is fully open when handle is pulled out and fully closed when it is pushed in. The damper must be **OPEN** before door is opened.
2. **Blower Control:** The blower control (Rheostat) is located on side of the unit. The rheostat is used to vary speed of blower. It can be set at any position. It must be turned on to activate automatic thermostat on stove.
3. **Primary Air Controls:** The primary air intake draft controls (4) are located at left and right bottom side of hearth. They are operated by moving handle **out** to open (to allow air into the firebox) or **in** (to control or close off) air into firebox. Shot gun air control, allows air to center of firebox of stove (4a).
4. **Warm Air Outlets:** Provides heat extraction from top of firebox.
5. **Baffles:** Directs air flow around unit for maximum heat transfer.
6. **Air Inlet:** Allows cool air near floor to be circulated through blower and back into warm air chamber of heater.
7. **Door:** Provides an "airtight" feature. The door allows a much higher burning efficiency than can be obtained with an open firebox.
8. **Hearth Extension:** Offers protection from spilled ashes and cinders.
9. **Power Cord:** Provides electrical power to operate blower.
10. **Catalyst:** Enables Unit to burn cleanly and efficiently.
11. **Catalyst Probe:** Probe is located right of the bypass damper rod. It is used to determine (catalyst) temperature.
12. **Automatic/Off/Manual Switch:** Located behind right cover door under hearth. In the "Manual" position, the blower operates continuously. In "Automatic" position, blower is controlled by internal thermostat which reacts to temperature of air between the stove walls. (Not same as the temperature showing on the Catalyst Probe.)

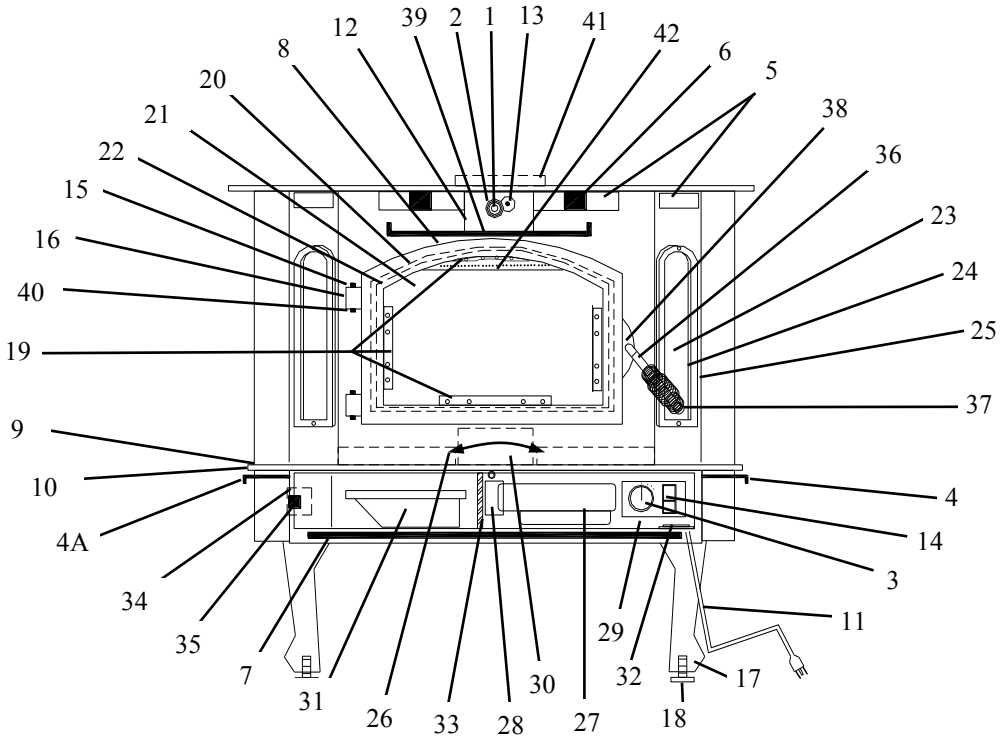
SAFETY STANDARD COMPLIANCE

The Model 91 Bay catalytic solid fuel (wood) burning combination room heater/fireplace stove manufactured by New Buck Corporation complies with UL 1482-(1996),: UL 1482 (2006): UL 1482 (2010) and UL 737-1995 for residential freestanding and masonry fireplace insert installations when constructed and installed in accordance with **ITS** approved documentation.

EPA COMPLIANCE STATUS

This manual describes installation and operation of the **New Buck Corporation Model 91 Bay** wood heater. This heater meets the U.S. Environmental Protection Agency's Emission limits for wood heaters sold after May 15th 2020. Under specific test conditions, this heater has been shown to deliver heat at rates ranging from approximately 8,500 to 62,745 BTU/hr for the Model 91 Bay. A weighted average was used to calculate the overall efficiency across all of the burn rate categories using the higher heating value (HHV 80.46%).

MODEL 91 WOOD STOVE IDENTIFICATION



1. Bypass Damper
2. Bypass Damper Spring Handle
3. Blower Control (Rheostat)
4. Primary Air Control Air Wash Rod for Both Sides

4a. Shot Gun Air Control

5. Warm Air Outlets
6. Baffles (Interior of Stove)
7. Air Inlet
8. Door
9. Hearth Extension
10. Hearth Trim
11. Power Cord
12. Catalyst (Interior Firebox)
13. Catalyst Probe
14. Automatic / Off / Manual Switch
15. Brass Cap
16. Hinge Block
17. Quean Ann Legs
18. Leveling Screws
19. Glass Clips/Large; Side, Top, Bottom
20. Door Gasket
21. Door Glass
22. Door Glass Gasket
23. Side Glass
24. Side Glass Gasket
25. Overlays
26. Firebrick
27. Motor
28. Motor Mount Bracket
29. Cover Door
30. Shot Gun Air Box
31. Ash Pan
32. Disc Thermostat
33. Cover Door Hinge
34. Magnet Holder
35. Cover Door Magnet
36. Door Handle
37. Spring Handle
38. -Door Latch
    -Door Latch Screw
    -Door Handle Bushing
    -Door Handle Spacer
    -Door Latch Flat Washer
    -Door Latch Screws (Phillips Head)
    -Door Latch Screws (Allan Head)
39. Lower Heat Shield
40. Hinge Pins
41. 8" Flue Exit
42. Air Wash Screen

CATALYST EQUIPPED

"This wood heater contains a catalytic combustor, which needs periodic inspection and replacement for proper operation. It is against federal regulations to operate this wood heater in a manner inconsistent with operating instructions in this manual, or if the catalytic element is deactivated or removed."

"Combustors should be visually inspected at least three times during the heating season to determine if physical degradation has occurred. Actuall removal of the combustor is not recommended unless more detailed inspection is warranted because of decreased performance. If any of these conditions exists, refer to Catalyst Troubleshooting section of this owner's manual."

CATALYST WARRANTY

The combustor supplied with this heater is a set of (3) (2" x 3-1/2" x 6" x 25" cells). Consult catalytic combustor warranty also supplied with this heater. All warranty claims should be addressed to:

Applied Ceramics
Customer Service Department
P.O. Box 29664
Atlanta, GA 30359
770-448-6888

See enclosed catalyst warranty for instructions. New Buck Corporation does not handle catalyst replacements. Customer can order directly from Applied Ceramics.

DO NOT USE CHEMICALS OR FLUIDS TO START THE FIRE.
DO NOT BURN GARBAGE OR FLAMMABLE FLUIDS."

PROPER FUEL SELECTION

For best results, this heater is designed to burn (dry), natural seasoned hardwood. Higher efficiencies and lower emissions generally result when burning air dried natural seasoned hardwoods, as compared to softwoods or freshly cut hardwoods. Green or freshly cut hardwoods (wood with high moisture content) will not produce the BTU's needed to heat your home. The result will be low temperature reading on the catalyst probe, thus low BTU output.

DO NOT BURN:

1) Treated Wood
2) Coal
3) Garbage
4) Cardboard
5) Solvents
6) Colored Paper
7) Trash

Burning treated wood, garbage, solvents, colored paper or trash may result in release of toxic fumes and may poison or render the catalytic combustor ineffective.

Burning coal, cardboard or loose paper can produce soot or large flakes of char or fly ash that can coat combustor, causing smoke spillage into room and rendering combustor ineffective. (Not covered under warranty.)

ACHIEVING CATALYTIC LIGHT-OFF

The temperature in stove and gases entering combustor must be raised to between 700° F to 900° F for catalytic activity to be initiated. The temperature can be determined by the Catalyst Monitor Probe. During start up of a cold stove a medium to high firing rate must be maintained for about 20 minutes. This can be achieved by starting fire with dry kindling, paper and small split wood. Have the Bypass Damper fully open (pulled out). This ensures that the stove, catalyst and fuel are all stabilized at proper operating temperatures. Even though it is possible (and likely) to have gas temperatures reach 600° F within two to three minutes after a fire is started, if the fire is allowed to die down immediately it may go out or the combustor may stop working. Once the combustor starts working, heat generated in it by burning smoke will keep it working.

ACHIEVING CATALYTIC LIGHT-OFF WHEN REFUELING

During refueling and rekindling of a cool fire, or a fire that has burned down to charcoal phase, operate stove at a medium to high firing rate for about 10 minutes to ensure that catalyst reaches approximately 800° F.

CATALYST MONITORING

It is important to periodically monitor operation of catalytic combustor to ensure that it is functioning properly, and to determine when it needs to be replaced. A non-functioning combustor will result in a loss of heating efficiency and an increase in creosote and emissions. See Troubleshooting section for detailed instructions **BEFORE** attempting to remove catalyst.

This catalytic heater is equipped with means to monitor catalyst operation. Properly functioning combustors typically maintain temperatures in excess of 1000^{o} F. If catalyst temperatures are not in excess of 500^{o} F, refer to Catalyst Troubleshooting section of this owner's manual.

⚠ CAUTION AGAINST OVER-FIRING

Do not over-fire this heater.

Attempts to achieve heat output rates that exceed heater design specifications can result in permanent damage to t heater and to catalytic combustor.

ASH REMOVAL

⚠ **CAUTION: Never remove ashes from heater with blower running.** Be sure to turn room air blower off before removing ashes

Whenever ashes build up in firebox and when fire has burned down and cooled, remove excess ashes. Leave an ash bed approximately 1 inch deep on firebox bottom to help maintain a hot charcoal bed. To remove ashes the dump is located at left inner bottom. By lifting dump door, place ashes through the dump opening. The ashes fall directly into ash pan. The ash pan is located at left side under the hearth behind cover door.

NOTE: Be sure to turn room air blower off before removing ashes. Open cover door and slide ash pan out.

NOTE: Fueling and ash removal door (s) must remain closed when in operation.

Ashes should be placed in a metal container with a tight fitting lid. The closed container of ashes should be placed on a non-combustible floor or on ground, away from all combustible materials, pending final disposal. The ashes should be retained in the closed container until all cinders have thoroughly cooled.

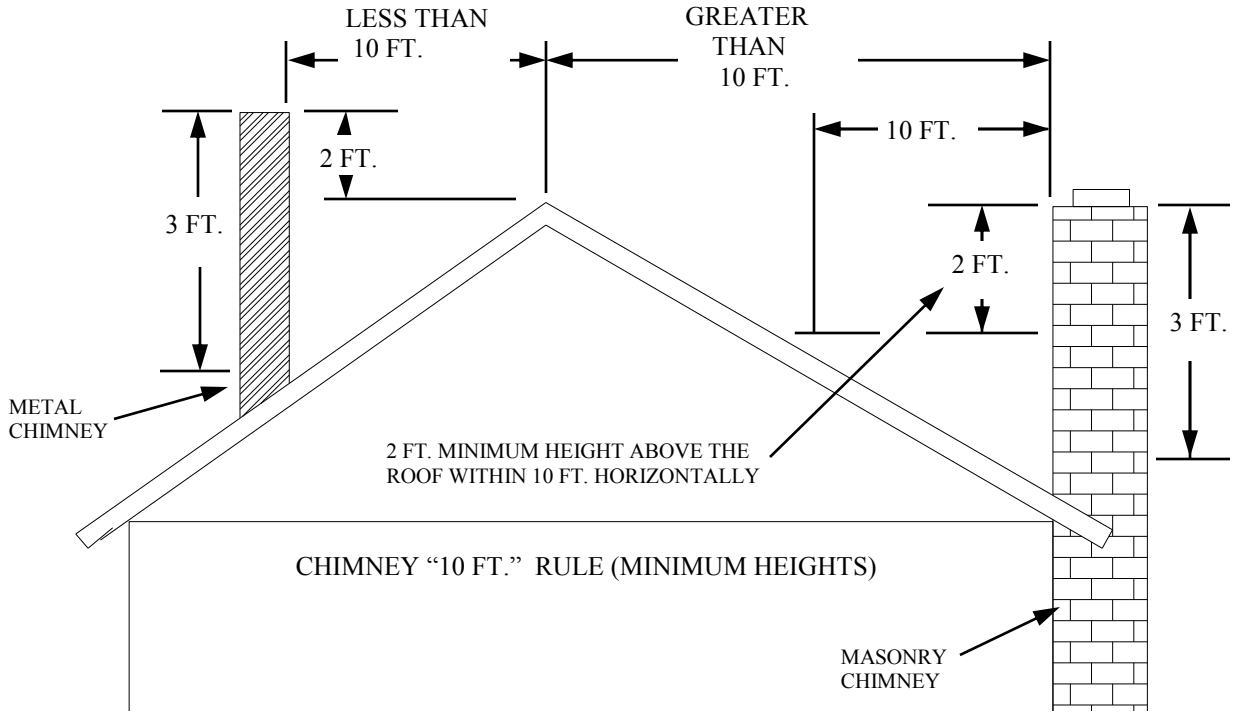
NOTE: Be sure to turn room air blower back on when job is completed.

NOTE: The room heater is not to be connected to any air distribution duct.

CREOSOTE - FORMATION AND NEED FOR REMOVAL

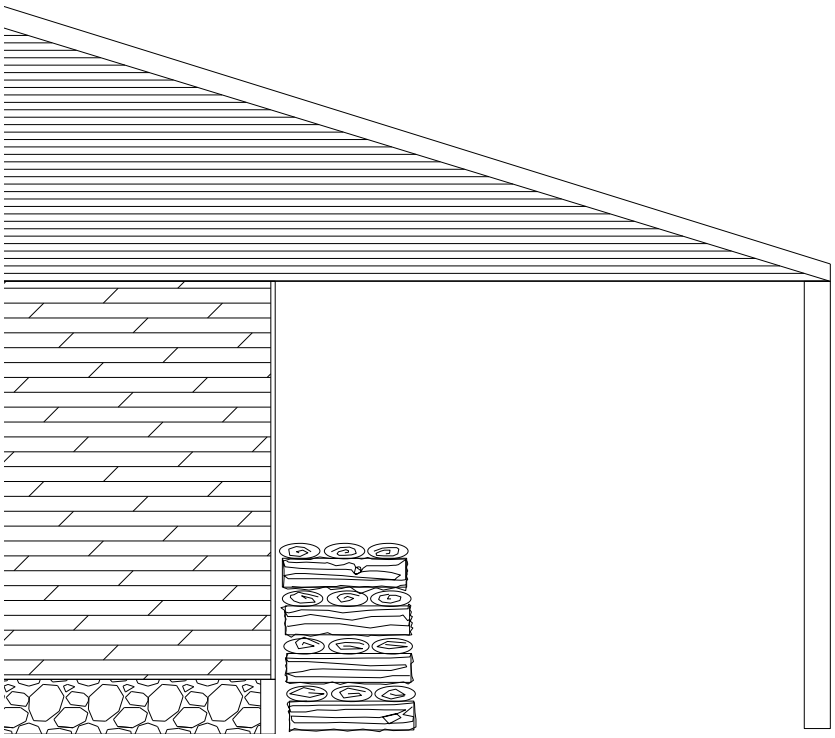
When wood is burned slowly, it produces tar and other organic vapor, which combined with expelled moisture forms creosote. The creosote vapors condense in a relatively cool chimney flue of a slow-burning fire. As a result, creosote residue accumulates on flue lining. When ignited, this creosote makes an extremely hot fire.

CHIMNEY HEIGHTS



NOTE: MINIMUM CHIMNEY HEIGHT 15 FT.

HOW TO STACK WOOD



Stack wood in criss-cross pattern under a shelter to allow air flow to dry wood and to keep wood from rain. Green wood may have 50-60% moisture content. Wood seasoned outside uncovered may have 40% moisture content. Wood properly seasoned in a covered environment will have less than 20% moisture content.

SECTION II

MASONRY INSERT INSTALLATION

INSTALLATION OPTIONS

This unit (appliance) may be installed into an all masonry fireplace, built in accordance with Uniform Building Code and National Fire Protection Association *(NFPA 211).*

NOTE: *Check with local building officials for any permits required for installation of this stove and notify your insurance company before proceeding with installation.*

OPTION A. (See Below See Figure 4).

At a minimum, a **starter pipe** reaching from stove flue exit to base of existing code approved masonry chimney (flue-liner) and an airtight face seal.

OPTION B. (See Page 9 Figure 5).

Direct connection: In accordance with **NFPA-211-9-4.5, Connection to Masonry Fireplaces**. A solid fuel-burning appliance such as a stove or insert shall be permitted to use a masonry fireplace flue where the following conditions are met:

Exception: Listed fireplace accessories shall be permitted to use a masonry fireplace flue.

1. There is a connector that extends from the appliance to flue liner.
2. The cross-sectional area of flue is no more than three times the cross-sectional area of flue collar of appliance.
3. If appliance vents directly through chimney wall above smoke chamber, there shall be a noncombustible seal below the entry point of the connector.
4. The installation shall be such that the chimney system can be inspected and cleaned.
5. Means shall be provided to prevent dilution of combustible products in the chimney flue with air from the habitable space.

OPTION C. (See Page 9 Figure 6).

It may be necessary to **positive connect** this unit to enhance the performance, if any of the following conditions exists:

1. Poor Drawing Flue
2. Oversized Flue (17" x 7)
3. Double Flues
4. Ash Dump
5. Stone Front Fireplace/ or damaged flue liner
6. Chimney that does not exceed 12'

Check with your dealer if any of above conditions exist before installing your stove. Proper installation is critical to the performance of the Model 91.

Use Fireplace Kit PA FP91 for installation. An optional oversized fireplace kit is available for larger fireplaces. Check with dealer.

SAFETY NOTICE

If this appliance is not properly installed, a house fire may result. For your safety, follow the installation directions. Contact local building or fire officials about restrictions and installation inspection requirements in your area.

OPTION (A)

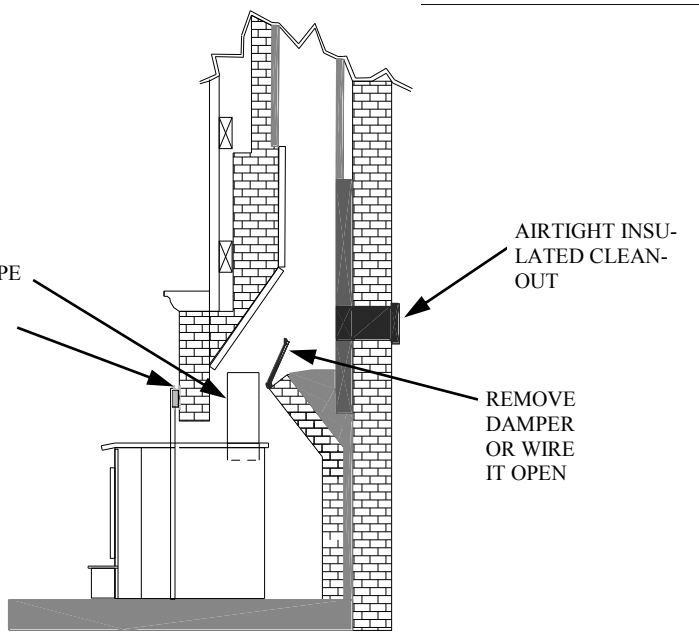


FIGURE 4

NOTE: New Buck Corporation grants no warranty, implied or stated, for the installation or maintenance of your appliance, and assumes no responsibility of any consequential damage

OPTION (B)

NOTE: Follow installation instruction with Direct Connection Kit.
(Kit sold separately)

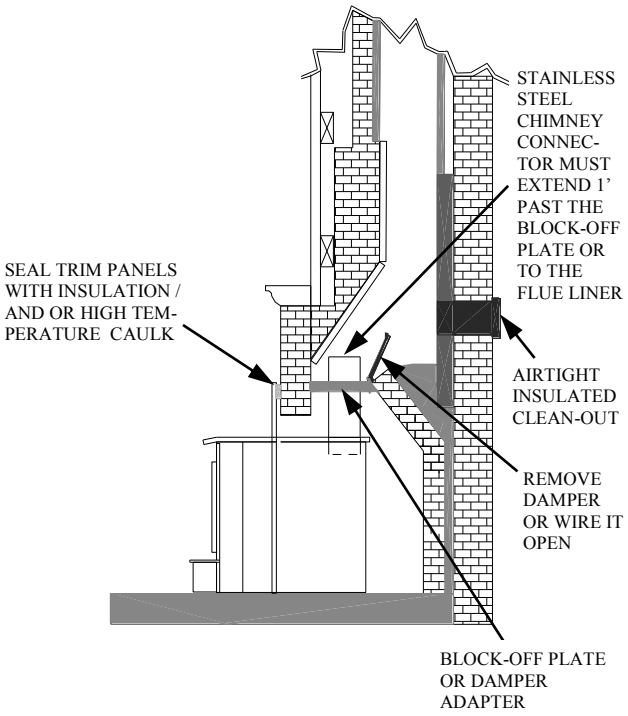


FIGURE 5

OPTION (C)

NOTE: Follow installation instruction with Positive Connection Kit.
(Kit sold separately)

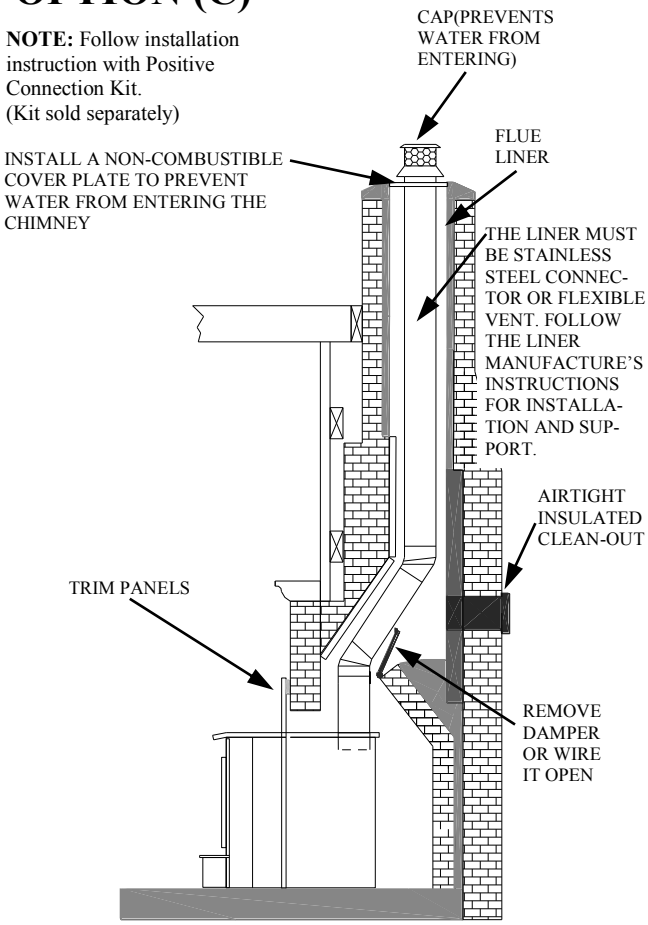


FIGURE 6

INSTALLATION (Fireplace Insert)

Minimum Clearances to Combustible Materials (in inches)

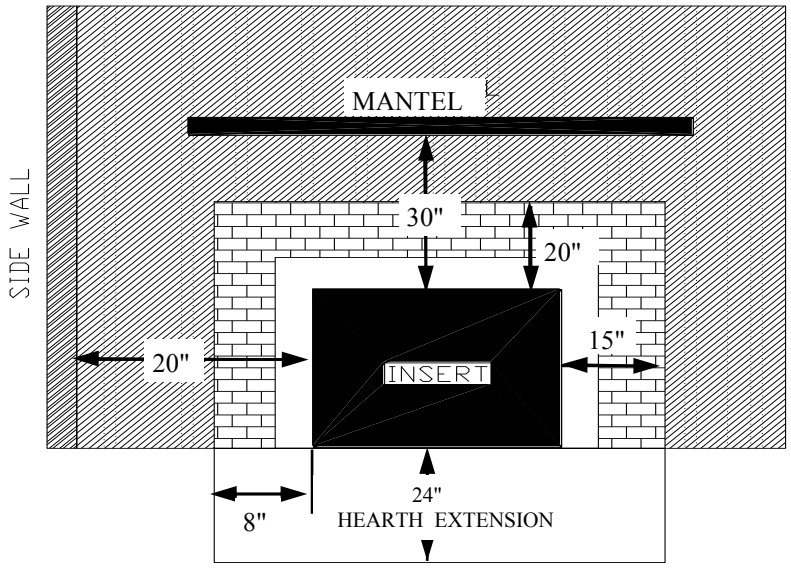


FIGURE 7
FIREPLACE INSERT

MINIMUM CLEARANCES:

The Model 91 Bay Fireplace Insert is intended for installation in accordance with standard for chimneys, fireplaces, vents and solid-fuel burning appliances. **NFPA-211** Code: **NOTE-**This model is not intended for installation into Zero Clearance or pre-fabricated fireplace.

1. The hearth must be of masonry construction and must extend a minimum of 24" in front of firebox opening and a minimum of 8" to either side of firebox opening.
2. Floor protector must be 3/8" minimum thickness non-combustible material or equivalent.
3. If your fireplace has wood trim above it, the wood trim must be at least 20" above top of unit and may be a maximum of 1/2" thick.
4. If your fireplace has a wood mantel, mantel or mantel supports must be located at a height of 30" above top of the stove.

REQUIRED FIREPLACE DIMENSIONS

Minimum fireplace dimensions:

	Height Min.	**Width Min.**	**Depth Min.**
Model 91 Bay	23 1/2"	31 3/4"	15 1/2"

POSSIBLE TOOLS NEEDED FOR INSTALLATION

If you decide to install your own stove, there are several hand tools you may need to do job. If you do not already have them, they are readily available at most hardware stores.

Caulking gun
Large adjustable wrench (may not be needed)
Drop cloths or newspapers
Vacuum cleaner or whisk broom
Flashlight
1 tube of RTV silicone, Code 103 or 106, or high temperature rubber cement rated between 450^{o} F- 600^{o} F.
7/32" drill bit and drill
Socket/Ratchet Set
Insulation (Provided in Trim Kit package)

INSTALLATION PREPARATION

Fireplace:

1. Locate furniture and other materials away from front of fireplace to allow free access to fireplace.
2. Cover hearth and adjacent floor areas with drop cloths to protect from soiling or marring surface.
3. Remove existing fireplace damper plate.
4. Thoroughly clean the fireplace of ashes and soot.
5. Have your existing chimney inspected before inserting this unit. Some chimneys must be relined or replaced before they are safe to use.
6. Check the chimney and smoke chamber for excessive buildups of creosote or soot. Also, check for obstructions, such as bird's nests. If chimney is excessively dirty, clean it or have someone clean it professionally **BEFORE** installing or using room heater.
7. If fireplace has an ash dump or outside air provision, these must be sealed off with metal or tightly packed non-combustible insulation to prevent cold air from entering fireplace chamber.

Heater:

1. Inspect unit for any obvious physical damage.
2. Check primary air draft controls to ensure that they slide freely.
3. Check operation of damper control to ensure it will open and close properly.
4. Check Manual/Automatic Switch to ensure that motor is working. *Place switch in the "MANUAL" position. (Plug in stove.) You cannot check motor in the "AUTOMATIC" position, unless a heat gun is used to heat internal thermostat.

POSITIONING THE HEATER

When positioning heater, the following conditions **MUST** be met! (See Figure 8.)

1. The front of damper opening must be positioned **BEHIND** back edge of lintel to ensure proper draft. (See Figure 8.)
2. The vertical plane of fireplace front must fall **BEHIND** side panels of the unit. (In other words, it is possible to have heater too far in as well as not far enough.)
3. Center the heater in fireplace opening.

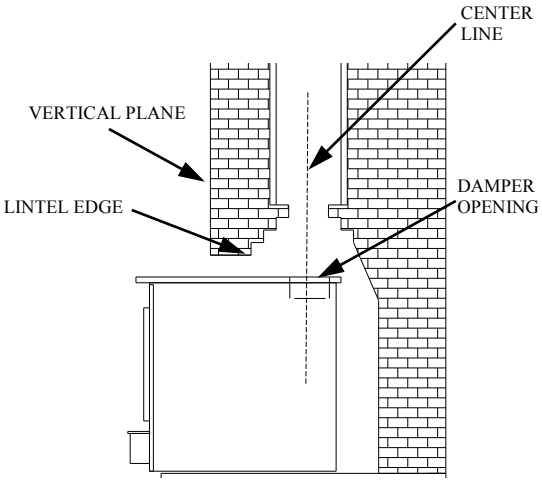


FIGURE 8 POSITIONING

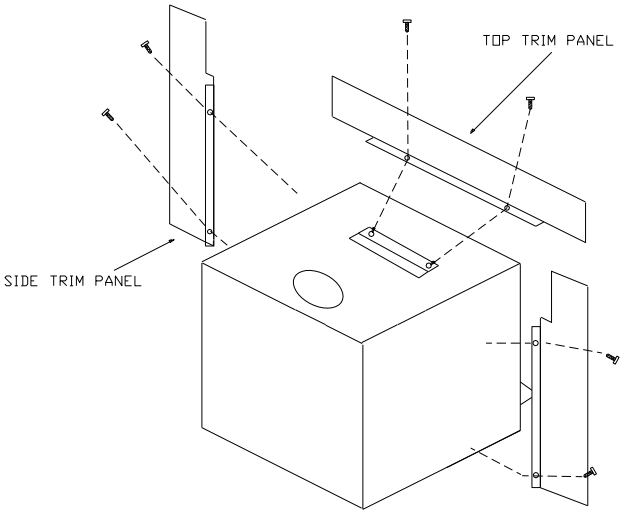


FIGURE 9 MOUNTING TRIM PANELS

MOUNTING TRIM PANELS

After unit is positioned, mark mounting position of trim panels as follows:

1. Place side trim panels flat against face of fireplace. Mark inside edge of trim panel to make a vertical reference line. (See Figure 9.)

2. Place top (long) trim panel on top of unit. The panel should be flat against outside face of fireplace, and standing vertically. Mark lower edge of trim panel with a pencil to make a reference line for mounting.

3. Slide unit out of fireplace far enough to work behind trim panel reference lines.

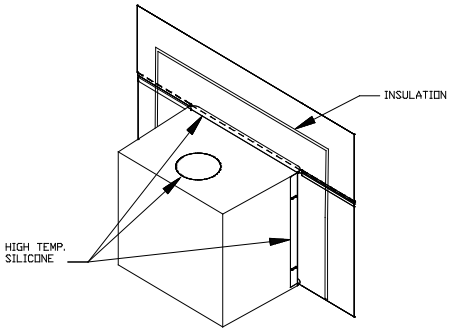
4. Mount side trim panels. (See Figure 9.)
   a. Position trim panel on reference line.
   b. Drill mounting holes in center of trim panel mounting brackets to allow for adjustment in and out if necessary.
   c. Mount trim panel using self-tapping screws provided.

5. Place top panel back on reference mark. Top trim panel mounting bracket is supplied with unit. Position bracket so it overlaps rear lip of top trim panel. Drill mounting holes in top of stove using holes in bracket as guide. Tighten screws.

6. Follow installation procedures in listed direct connect or positive connect kit you are using and install heater and connect kit in fireplace.

7. Slide unit back into fireplace. Check to be sure that trim panels are properly positioned and lie flat against front of fireplace. If one or more of panels is out of position, slide unit out and reset by loosening mounting screws and repositioning in slot.
8. Reinstall top trim panel by sliding rear lip of top trim panel underneath front lip of mounting bracket.
   NOTE: Mount top trim panel so that it sits in front of top of side trim panels..
9. Obtain brass trim kit provided with unit and slip over top and sides of trim panels. (Top ends of brass may need to be trimmed to fit.)
10. Ensure that starter pipe or connector is properly secure in stove flue exit, and aligned with chimney flue.
11. Mount top trim panel by drilling mounting holes in center of trim panel mounting brackets, with top end side of top panel overlapping side panel.
12. Using insulation provided, peel and stick to back of panels overlapping fireplace dimensions by 1" on each side and top. (See Figure 10.)
13. Using high heat silicone or furnace cement run heavy bead of caulking where panels meet stove. (See Figure 10.)
14. Slide unit back into fireplace. Check to be sure that trim panels (and brass) are properly positioned and lie flat against front of fireplace. If panels are out of position, slide unit out and reset by loosening mounting screws and repositioning in slot. With bar, lift stove up in front. Place insulation across front and surface of hearth or bottom of fireplace to make complete seal.
15. To check seal of panels, use candle flame and go around entire area sealed by silicone and insulation. If flame leans toward inside of fireplace, add additional insulation. This ensures an airtight seal.

FIGURE 10

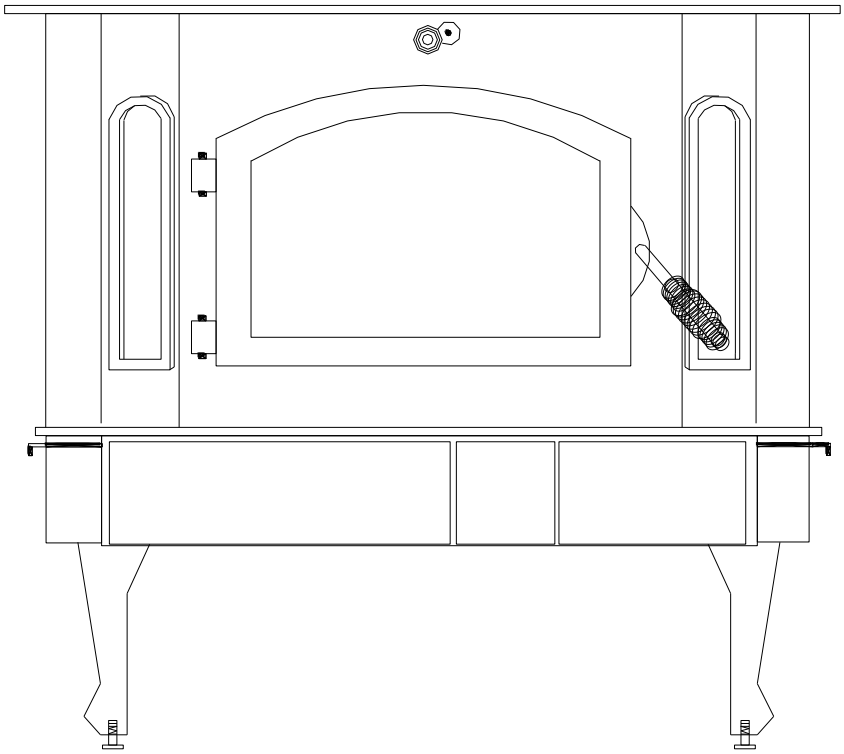


FINAL CHECK

1. Recheck specified clearances.
2. Remove all foreign material from firebox area.
3. Open primary air draft, shot-gun air draft and damper bypass, make sure ash drawer is sealed properly.
4. Plug power cord into a 115V AC outlet. Set switch to “Manual” and rheostat to “High” position to ensure motor operates properly.
5. Place 4 or 5 pieces of newspaper in stove. Light paper and close door. Ensure that stove draws properly through primary drafts.
6. Check for smoke leaks around door.
7. Open door (slowly) and check for smoke escaping from front of stove. Smoking usually indicates a defective or poorly positioned chimney. Some chimneys with a marginal draft can be preheated by lighting newspaper and holding it near the open damper with a poker or fire tong. Once chimney heats up, a proper draft can usually by obtained.
   NOTE: A poor drafting chimney can lead to poor heater performance. This is not a defect of the heater, but with the chimney. Poor performance due to a poor drafting chimney is **NOT** a warranty problem.
   If a thorough review of Troubleshooting Guide does not solve your problem,
   contact your dealer for assistance. If homeowner installed unit himself, there generally is a charge for dealer to service the stove and inspect installation.
8. The unit is painted with a specially formulated high temperature paint that cures during the first two or three firings. DO NOT BUILD A LARGE ROARING FIRE UNTIL THIS CURING IS COMPLETE OR HEATER FINISH MAY BE DAMAGED. (Paint may blister or peel off. This is not covered by warranty.) You may notice a slight smoking effect and an odor of burning paint when you build the first fires. This is normal and is not a cause for alarm. In some cases these fumes will activate a smoke alarm. Opening a window near unit will allow these fumes to escape.

SECTION III

RESIDENTIAL FREESTANDING ROOM HEATER INSTALLATION



INSTALLATION PRECAUTION

Extensive field and laboratory testing has shown that catalytic stoves perform best as freestanding stoves when vented into a masonry chimney that include the following:

1. A rain cap is installed on the chimney.
2. Height of chimney is at least 15 feet high.
3. Location of chimney is on interior. (Not on an outside wall)

Satisfactory results have been reported with installations other than listed above. However, draft problems are possible if a hot chimney is not maintained.

Use Leg Kit # FA FS2191 for Model 91

CAUTION: Do not connect this unit to a chimney flue serving another appliance.

MINIMUM CLEARANCES

The New Buck Corporation Model 91 Bay must be installed in compliance with instructions contained in this manual.

Clearance from combustible walls and ceilings. (Using single wall chimney connector)

The minimum lateral distance between any part of room heater and combustible walls is shown in (Figures 12 and 13).

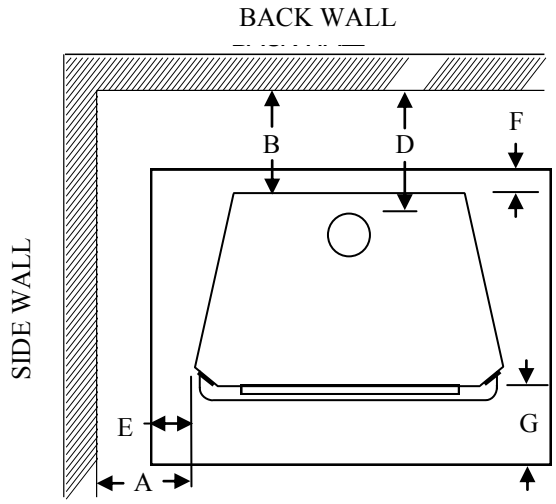
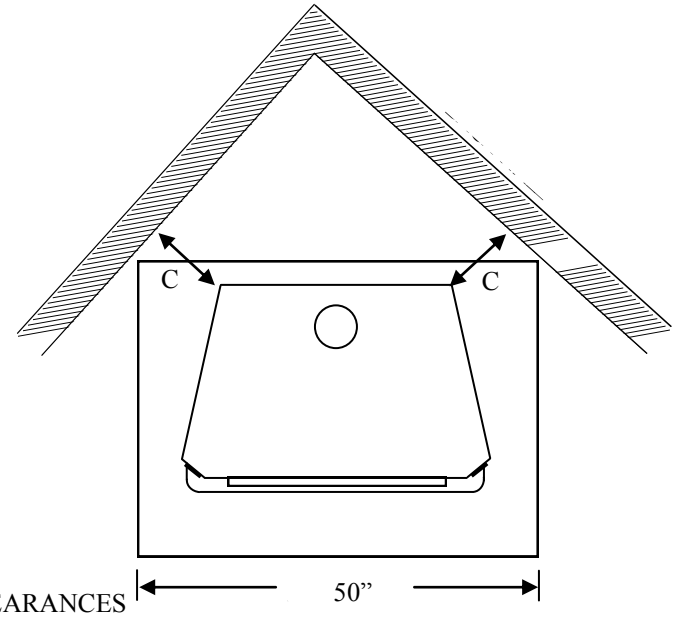


FIGURE 12



MINIMUM CLEARANCES

FIGURE 13

	A	B	C	D	E	F	G
MODEL 91	24”	23”	16”	26”	8”	3”	16”

FLOOR PROTECTION

If a freestanding model is to be installed on a combustible floor, a non-combustible pad must be placed under unit to protect floor from burning material from the stove. The pad must be 50 inches wide. **NOTE:** The floor must extend 16" from door opening in front of stove, 8" from door opening on each side of unit and should be under the chimney connector. Floor protector must be 3/8" in minimum thickness, non-combustible material or equivalent.

NOTE: For clearance reductions using wall protectors, refer to the **NFPA-211** Code.

TOOLS FOR INSTALLATION

Drop Cloth
Electric Drill with 7/32" drill bit
1/2" - 9/16" combination wrench
3/8" magnetic socket chuck adapter, 3/8" wrench (box or socket) or adjustable wrench
Socket Set
Tape Measure
Pencil
Level
Screw Driver

MINIMUM CLEARANCES

FLOOR PROTECTION

Floor protector must be 3/8" minimum thickness non-combustible material or equivalent.

How to use alternate materials and how to calculate equivalent thickness

An easy means of determining if a proposed alternate floor protector meets requirements listed in the appliance manual is to follow this procedure:

1. Convert specification to R-value:
   R-value is given—no conversion is needed.
   K– factor is given with a required thickness (T) in inches:
   C-factor is given: R=1/C
2. Determine the R-value of the proposed alternate floor protector.
   Use the formula in step (1) to convert values not expressed as "R"
   For multiple layers, add R-values of each layer to determine the overall R-value.
3. If the overall R-value of the system is greater than the R-value of the specified floor protector, the alternate is acceptable.

Example:
The specified floor protector should be 3/4" thick material with a K-factor of 0.84.
The proposed alternate is 4" brick with a C-factor of 1.25 over 1/8" mineral board with a K-factor of 0.29.

Step (a): Use formula above to convert specification to R-value. R= 1/K x T = 1/0.84 x .75 = 0.893

Step (b): Calculate R of proposed system. 4" brick of C=1.25, therefore Rbrick = 1/C = 1/1.25 = 0.80 1/8" mineral board of K = 0.29, therefore Rmin.bd. =1/029 x0.125 = 0.431

Step (c): Compare proposed system R of 1.231 to specified R of 0.893. Since proposed system R is greater than required , the system is acceptable.

Definitions:

Thermal conductance $= C = \frac{Btu}{(hr)(ft^2)(°F)} = \frac{W}{(m^2)(°K)}$

Thermal conductance $= K = \frac{(Btu)(inch)}{(hr)(ft^2)(°f)} = \frac{W}{(m)(°K)} = \frac{(Btu)}{(hr)(tf)(°F)}$

Thermal conductance $= R = \frac{(ft^2)(hr)(°F)}{Btu} = \frac{(m^2)(°K)}{W}$

Install in accordance with 24 CFR, Part 3280 (HUD).

PREPARING THE STOVE FOR INSTALLATION

1. Inspect unit for any obvious physical damage.
2. Check primary air draft controls to ensure that they operate freely.
3. Check operation of bypass damper control to ensure that it will open and close properly.
4. To attach legs, remove any items within firebox. Spread drop cloth on floor behind heater. Tilt heater so that back is on drop cloth. Attach legs to pre-drilled holes in bottom of heater. If using optional pedestal, mounting holes will need to be drilled.
5. Reposition heater to upright position.
6. Plug power cord into a **115V AC** outlet. Set switch to "Manual" and rheostat to "High" position to ensure motor operates properly. You cannot check motor when switch is in the "Off" or "Automatic" position, unless a heat gun is used to heat internal thermostat.

CHIMNEY

Ceiling Exits:

The Model 91 Bay is designed for connection to: 1) Simpson Dura-Vent, 2) Security, 3) Selkirk Metal 4) Metal Fab, 5) Air Jet, listed as 2100^{o} pipe and parts.

Follow chimney and chimney connector manufacturers instructions and local building codes for installation through combustible walls or ceilings. This heater can only be installed freestanding by using one of the following requirements: 1) Must use a brand of chimney pipe, as listed above, complying to the requirements for Type HT chimneys in the standard code for chimneys, Factory-Built, Residential Type and Building Heating Appliance, UL 103 or 2) A code approved masonry chimney with a flue liner.

CAUTION: Certain installation types require use of certain chimney types. Please follow these instructions exactly.

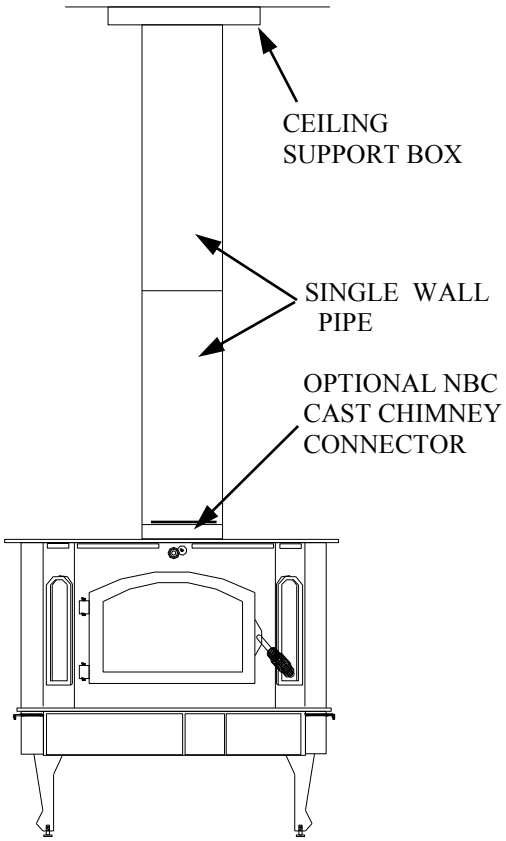


FIGURE 14

DETERMINING CHIMNEY LOCATION

A. Ceiling Exit (Using Single Wall Pipe and UL 103 HT type chimney system listed with manufacturers in this section of manual)

1. Suspend a plumb bob from ceiling above unit so that weight is hanging in the center of flue exit. (A small weight on a string will serve as a plumb bob.) Mark ceiling where string is suspended to locate center of chimney.
2. After locating the center of the hole, install the ceiling support box, chimney, flashing, and rain cap per the chimney manufacturer's instructions.
3. Connect stove to ceiling support box by using #24 ga. minimum blued or black steel chimney pipe. (DO NOT use galvanized pipe.) Each section should fit into section below or into opening on stove, for drip-free operation. Secure each section together by using at least three (3) sheet metal screws or rivets.
4. You may secure chimney pipe to stove two (2) different ways.
   a. With Optional NBC Cast Chimney Connector, (See Figure 14).
   b. Mounting clips attached to heater and chimney pipe, (See Figure 18,Page 18).

CLOSE CLEARANCE INSTALLATIONS (in inches)

Close clearance installation is possible by using the following brands of black, double-wall chimney pipe. (See Figure 15 and Figure 16 for clearances.)

1. Simpson Dura-Vent double wall chimney connector "Type DVL" and 8" Simpson Dura-Vent 2100° HT "Type DP" chimney
2. 8" Security Type DL double wall connector and 8" Security Type "ASHT" High Temp Chimney.
3. 8" Selkirk Metal Bestos Model "DS" double wall connector-8" Selkirk Metal Bestos Model SSII type HT Chimney System.
4. 8" Metal Fab type "DW" double wall connector - 8" Metal Fab 2100° HT chimney.
5. 8" Air Jet

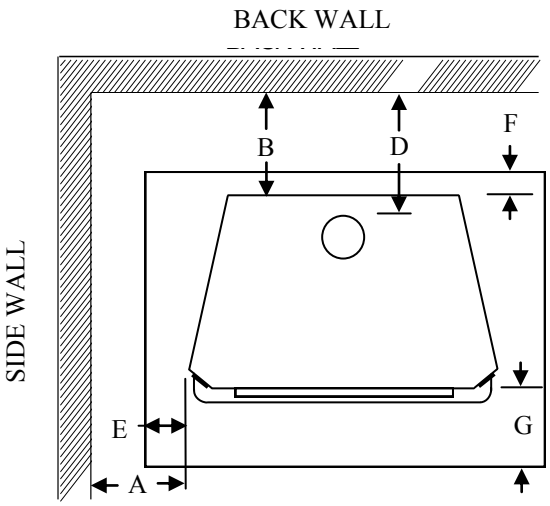


FIGURE 15

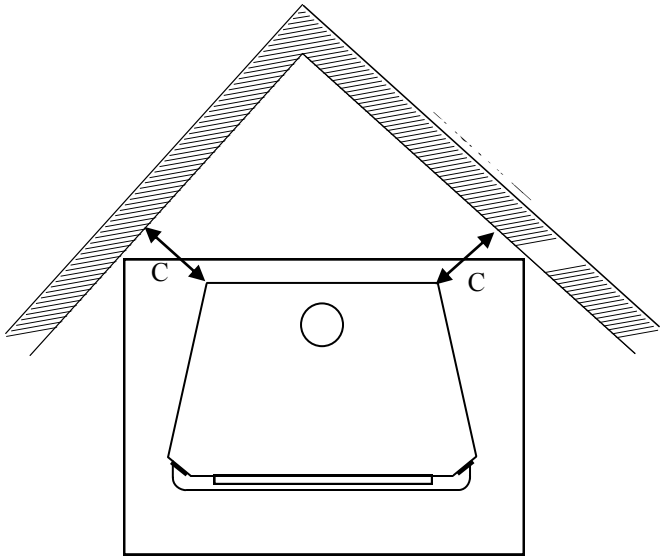


FIGURE 16

MINIMUM CLEARANCES

	A	B	C	D	E	F	G
MODEL 91	14"	14"	12"	16"	8"	8"	16"

Wall Exit into Metal Tee-Box (Using Single Wall Pipe)

TOOLS FOR INSTALLATION

Drop Cloth
Electric Drill with 3/32" drill bit
5/16" combination wrench
5/16" magnetic socket chuck adapter,
5/16" wrench (box or socket) or adjustable wrench
Pencil Socket Set
Level Tape Measure
Screw Driver

1. Mark plumb line on the wall directly behind the center of heater. (See Figure 17.)
   NOTE: When using #24 ga. min. blue or black steel pipe, maintain 18" between pipe and ceiling.
2. Place vertical portion of heater pipe and elbow in position and project a point onto plumb line level with center of elbow.
3. Measure so there will be at least 1/4" rise per foot of horizontal connector pipe, maintaining clearances to ceiling as noted in Figure 18. This will give you the center of the hole for chimneypenetration.
4. After locating center of penetration, install tee-box and chimney as per chimney manufacturer's specifications.
5. Connect chimney pipe to tee-box using #24 ga. minimum blued or black steel pipe. (DO NOT use galvanized pipe.) Each section should fit into section below or into opening on stove, for drip-free operation. Secure each section together by using at least three (3) sheet metal screws or rivets.

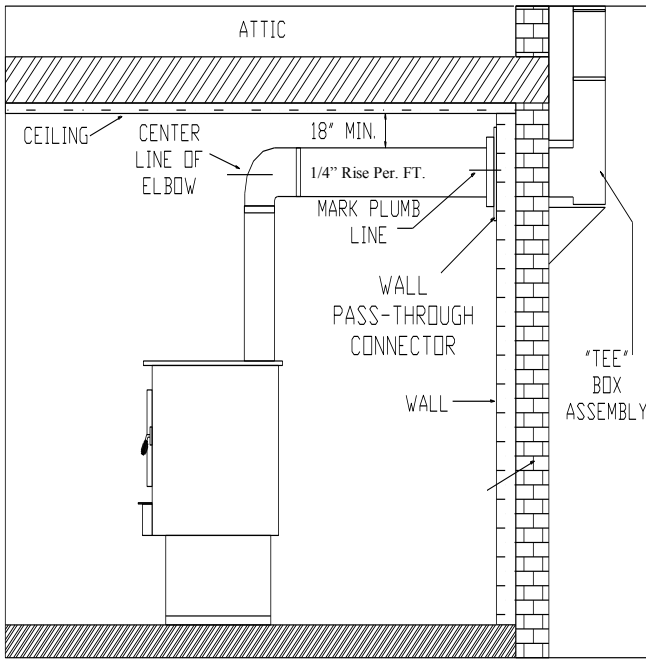


FIGURE 17

Wall Exit Into Masonry (Using Single Wall Pipe)

1. Before connecting Model 91Bay to a masonry chimney, determine if masonry fire-place wall pass-through connector thimble meets **NFPA-211** Code and local building codes and is a minimum of 18" from ceiling. If connector thimble does not meet these codes, the pass-through connector must be modified.

Connectors may pass through walls or partitions constructed of combustible material if connector is:

(a) Either listed for wall pass-through or is routed through a device listed for wall pass-through and is installed in accordance with conditions of listing.

(b) Selected or fabricated in accordance with conditions and clearances as stated in **NFPA 211**-Code. Any unexposed metal that is used as part of a wall pass-through system and is exposed to flue gases shall be constructed of stainless steel or other equivalent material that will resist corrosion, softening, or cracking from flue gases at temperatures up to 1800^{o} F.

In addition, a connector to a masonry chimney shall extend through wall to the inner face or liner but not beyond, and shall be firmly cemented to masonry.

EXCEPTION: A thimble may be used to facilitate removal of chimney connector for cleaning, in which case thimble shall be permanently cemented in place with high temperature cement.

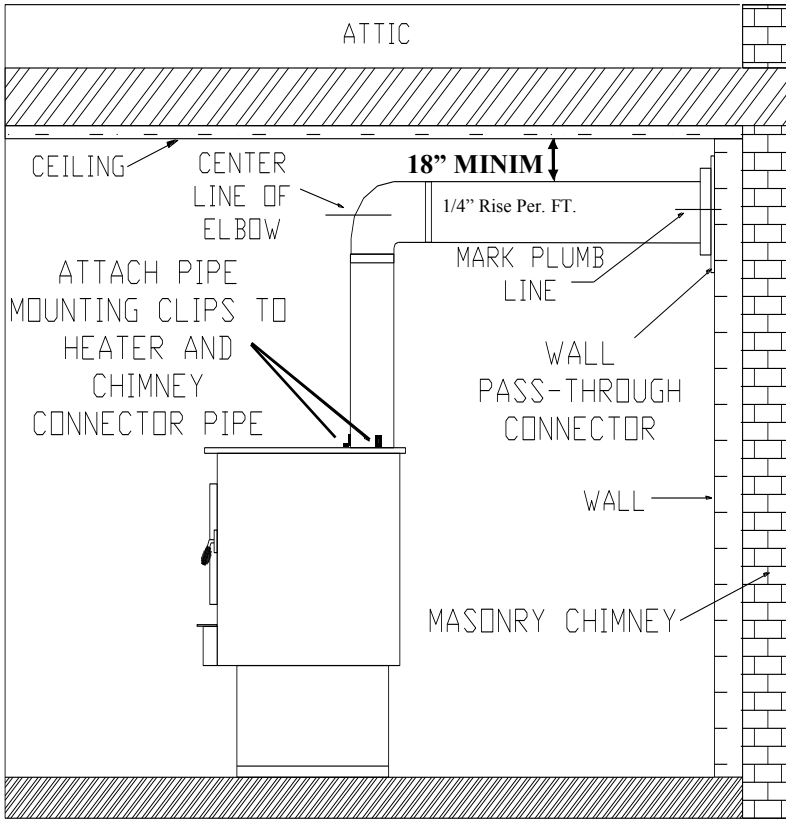
2. Once through-the-wall thimble codes are met, simply connect chimney pipe to the wall pass-through connector using #24 ga. minimum blued or black steel pipe as follows:

(a) Maintain 1/4" rise per foot (horizontal length) from the appliance to chimney.

(b) Each section of pipe should fit into section below or into opening on the stove for drip-free operation.

(c) Secure each section to each other using at least three (3) sheet metal screws or rivets.

FIGURE 18



Ceiling Exit - Close Clearance

1. Suspend a plumb bob from ceiling above unit so that weight is hanging in the center of flue exit. (A small weight on a string will serve as a plumb bob.) Mark ceiling where string is suspended to locate center of chimney hole.
2. After locating center of hole, install ceiling support box, chimney, flashing and rain cap.
3. Install Double Wall Connector and chimney system per manufacturer's written operating instructions. See manufacturer's list of tested pipes. See example of installation Figure 19.

CAUTION: Because of the high efficiency and low flue gas temperature, freestanding catalytic heaters connected to masonry chimneys with oversized flue liners may encounter drafting problems A positive flue liner (optional) may be necessary to help draft. A poor drafting chimney may result in poor performance from Model 91. This is not a defect of the Model 91 but a defect in the chimney. This is not a warranty problem with the Model 91. Contact dealer for possible solutions for chimney.

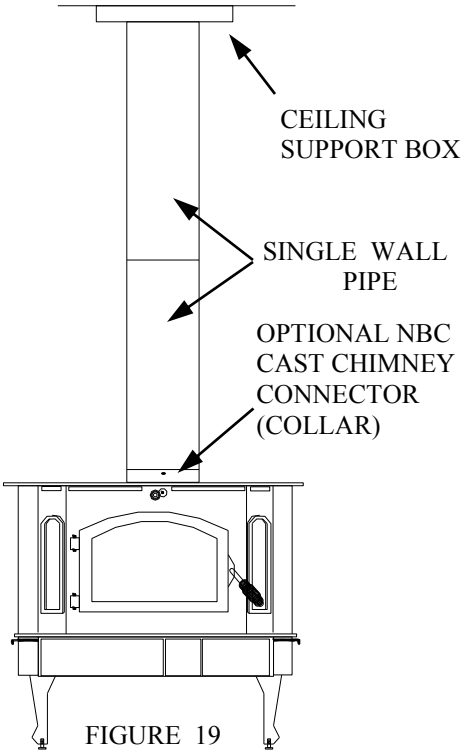
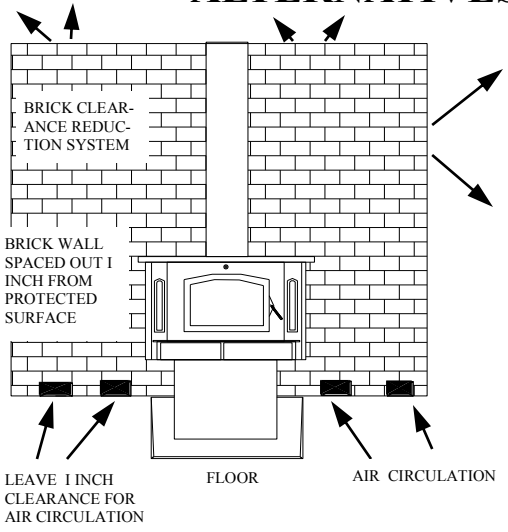


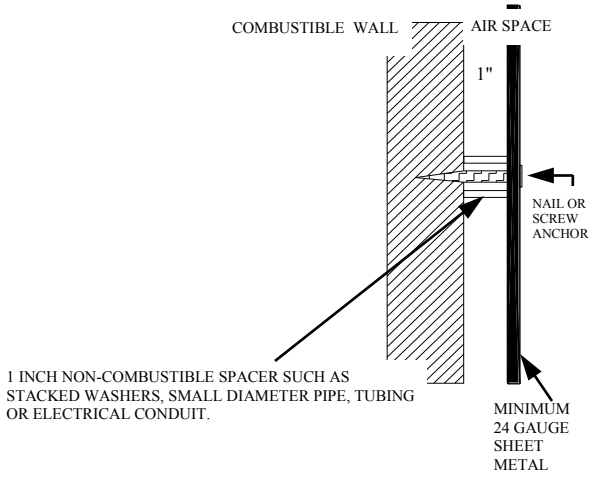
FIGURE 19

Example: The rear clearance for the Model 91 from page 17 is 14". (See Figure 15.) This clearance may be reduced by 50% to 9" by using either of the wall protection devices mentioned below Figure 20.

ALTERNATIVES FOR WALL PROTECTION



BRICK WALLS MAY BE ATTACHED TO COMBUSTIBLE WALLS USING WALL TIES IF BRICK IS USED. BE SURE FLOOR CAN WITHSTAND WEIGHT OF BRICK.



DO NOT USE FASTENERS DIRECTLY BEHIND CHIMNEY CONNECTOR OR STOVE.

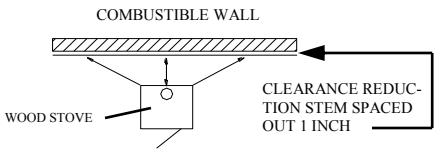
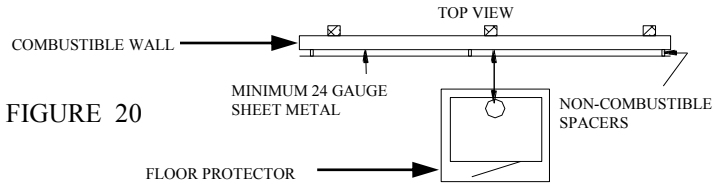


FIGURE 20



Tested and Listed Wall Protector

Clearances to combustibles may be reduced if a tested and listed wall protector is installed over a combustible surface when the following conditions exist:

1. A dead air space of 1" separates listed and tested wall protector from combustible surface.
2. The tested and listed wall protector extends form floor to ceiling with a 1" clearance for air circulation at both floor and ceiling.
3. The 1" spacers (preferably ceramic rather than metal) must be located at corners rather than behind heater or chimney connector.

Unlisted and Untested Wall Protector

Wall protectors may be constructed of masonry, 24 gauge or thicker sheet metal, or non-combustible 1/2" thick insulation board. Conditions 2 and 3 above must be observed but, the air space in condition 1 must be increased to 1 1/2".

FINAL CHECK

1. Recheck specified clearances.
2. Remove all foreign material from firebox area.
3. Open primary air draft; shot-gun air draft, and damper bypass. Make sure ash drawer is sealed properly.
4. Plug power cord into a 115V AC outlet. Set switch to “Manual” and rheostat to “High” position to ensure motor operates properly.
5. Place 4 or 5 pieces of newspaper in stove. Light paper and close door. Ensure that stove draws properly through primary drafts.
6. Check for smoke leaks around door.
7. Open door (slowly) and check for smoke escaping from front of stove. Smoking usually indicates a defective or poorly positioned chimney. Some chimneys with a marginal draft can be preheated by lighting newspaper and holding it near open damper with a poker or fire tong. Once chimney heats up, a proper draft can usually be obtained.
   NOTE: A poor drafting chimney can lead to poor heater performance. This is not a defect of heater, but with the chimney. Poor performance due to a poor drafting chimney is **NOT** a warranty problem.
   If a thorough review of Troubleshooting Guide does not solve your problem,
   contact your dealer for assistance. If homeowner installed unit himself, there generally is a charge for Dealer to service stove and inspect installation.
8. The unit is painted with a specially formulated high temperature paint that cures during the first two or three firings. DO NOT BUILD A LARGE ROARING FIRE UNTIL THIS CURING IS COMPLETE OR HEATER FINISH MAY BE DAMAGED. (Paint may blister or peel off. This is not covered by warranty.) You may notice a slight smoking effect and an odor of burning paint when you build the first fires. This is normal and is not a cause for alarm. In some cases these fumes will activate a smoke alarm. Opening a window near unit will allow these fumes to escape.

SECTION IV

WOOD HEATER SAFETY

Certain safety hazards are inherent in any wood heater installation. You should be aware of these so that a safe and proper installation can be made.

1. **FAULTY CHIMNEY:** An older masonry chimney should be thoroughly checked to be sure there are no holes or weak spots which could allow sparks or hot gases to escape. If any of these are present, a positive liner should be installed before heater is installed.
2. **HEAT CONDUCTION:** Placing combustible materials too close to a heater or chimney can be a fire hazard.

By keeping these particular hazards in mind as you install and use your room heater you can ensure a safe, reliable installation.

NOTE: Correctly place monitors in those areas that are expected to produce CO. Consult with your local fire safety officials to learn more

The connector and/or chimney should be inspected at least once a month during heating season to determine if a creosote buildup has occurred. Any buildup of soot should be removed to prevent risk of a chimney fire. To remove chimney or chimney connector, remove screws and/or fasteners. Remove pipe and clean with a steel wire brush. Replace chimney or chimney connector and replace screws and/or fasteners.

⚠ **CAUTION: NEVER** use gasoline, gasoline-type lantern fuel, kerosene, charcoal lighter fluid or similar liquids to start or "freshen up" a fire in the heater. Keep all such liquids well away from the stove when it is in use. All fluids of this type give off volatile fumes and can and **WILL EXPLODE!!** Don't take a chance with the safety of your home and family.

WARNING: Hot while in operation. Keep children, clothing and furniture away from stove. Contact may cause skin burns.

HELPFUL HINTS

CURING THE PAINT ON YOUR HEATER: During the first several firings, burn small fires to cure paint and to prevent damage to the finish. It is a good idea to flip the toggle switch to "Manual" position during these first firings so the blower will run continuously. This will allow paint to cure at a slower rate and creates a better overall finish.

⚠ **CAUTION:** Never remove ashes from your heater with the blower running.

TIPS ON FIRE BURNING

GREEN WOOD vs. NATURAL SEASONED HARD WOOD-Green wood has a high moisture content and therefore requires a hotter ignition temperature. Seasoned wood- cut at least one year before use allows for a quicker, prolonged burn and more complete combustion.

SPLIT WOOD vs. ROUND WOOD- Split wood burns easier and more rapidly, whether it's seasoned or green. If used after starting a fire, it should be packed tightly to achieve a longer burn.

Round wood burns longer, but requires more effort to start. Inserting a round piece over a bed of red coals with damper and drafts open will help it catch fire. Round wood should be used to accomplish an all-night burn.

SECTION V

OPERATION

This section of the manual is to help you get maximum efficiency and maximum smoke (particulate) reduction from your Model 91 heater. If you should experience any difficulty or have questions concerning your heater, contact your Model 91 dealer for assistance.

1."To maximize the efficiency of your wood stove make sure it is sized properly for the space you plan to heat. An oversized stove will burn and be forced to burn at a lower and dirtier burn rate. Consult with your dealer for sizing your stove correctly.
2. Use dry, seasoned wood only. Using wet wood will greatly reduce your efficiency.
3. Consult with your installer/dealer to correctly place the stove in your home. An incorrectly placed stove can greatly reduce efficiency. Maximizing the efficiency of your stove will heat your house quickly, burn cleaner and use less wood.
Use dried split wood (6-12 months) and placed from front to back position in heater. (See Page 7 Bottom Picture).

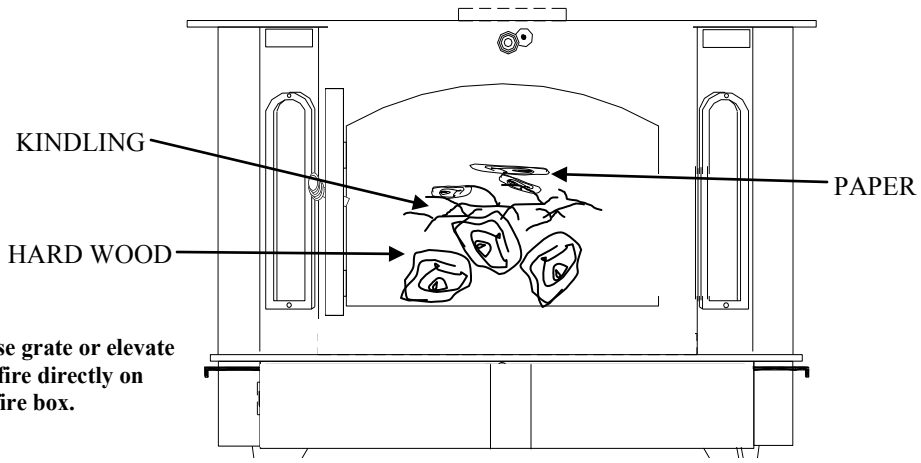
"This wood heater has a manufacturer-set minimum low burn rate that must not be altered. It is against federal regulations to alter this setting or otherwise operate this wood heater in a manner inconsistent with operating instruction in this manual."

NOTE: "Following all suggested operating and maintenance procedures will help minimize visual emissions.

GUIDE TO THE DIFFERENT BURNING QUALITIES OF WOOD

Type of Wood	Ease of Starting	Coaling Qualities	Amount of Sparks
Apple	Poor	Excellent	Few
Ash	Fair	Good	Few
Beech	Poor	Good	Few
Birch	Good	Excellent	Moderate
Cherry	Poor	Excellent	Few
Cedar	Excellent	Poor	Many
Elm	Fair	Good	Very Few
Hemlock	Good	Low	Many
Hickory	Fair	Excellent	Moderate
Locust	Poor	Excellent	Very Few
Maple	Poor	Excellent	Few
Oak	Poor	Excellent	Few
Pine	Excellent	Poor	Moderate

The Main Audubon Society recently charted the heat produced by a wood fire. They noted that heat produced by a wood fire varies greatly with kind of wood burned. Beech is considered best wood for a fire. A cord of well-seasoned Beech will produce as much heat as 169 gallons of fuel oil; Sugar Maple and Red Oak produce as much heat as 166 gallons of fuel oil; followed by White Ash 154; American Elm 130; White Birch 124; and White Pine 94.



NOTE: Do not use grate or elevate fire. Build wood fire directly on inner bottom of fire box.

BUILDING A FIRE:

1. Place "Manual/Off/Automatic" switch in "Automatic" (bottom) position for thermostat control operation. Turn rheostat knob clockwise (it will click from "Off" position to "On") so you can vary the speed of motor.
2. Open door.
3. While looking inside firebox, operate damper bypass plate in and out observing movement. This should operate freely and close completely. Open damper bypass. (Pull Out)
4. Open air controls on each side of stove (pull out).

The Model 91 Bay is not designed for use with grates and irons or other methods of supporting the fuel.

NOTE: Do not use grate or elevate fire. Build wood fire directly on inner bottom of fire box.

DO NOT BUILD A LARGE ROARING FIRE! **Initially**, build 2-3 small fires in order to cure the paint on your stove.

5. Load heater with 2 or 3 pieces of (naturally seasoned hard wood), 2"-3" in diameter **placing it on floor of firebox from front to rear.** See Page 22
6. Place kindling on top of dried hard wood.
7. Twist 4 or 5 pieces of non-colored newspaper in a roll and place on top of dry kindling.
8. Light newspaper, leave the door open around 2" inches for 1 1/2 to 2 1/2 minutes. Don't leave fire unattended with the door open!
9. After 3 to 4 minutes, close the by-pass damper completely (PUSH IN). Shut the feed door.
10. After embers and a coal bed have been established, load heater with natural seasoned hard wood, **placing it from front to rear**.
11. Remember on NEW STOVE-DO NOT FILL firebox during your first 2 to 3 fires! Build 2-3 small fires in order to cure the paint on your stove

NOTE: THE FUELING DOOR MUST REMAIN CLOSED DURING OPERATION.

NOTE: Your stove is equipped with a automatic thermostat. When the stove gets hot enough, the thermostat will activate the room air blower. Set fan speed according to desired heat output.

NOTE: When refueling or removing ashes turn "OFF" room air blower. Be sure to turn room air blower back on when finished.

NOTE: Do not run power cord underneath heater, or in walk way or heavy traffic areas.

BURN RATES:

A. **Low Burn Rate:** Set air controls (both) all the way closed. Set rheostat for fan control between low to medium speed. This burn rate is most desired and most efficient, but can only be achieved after a fire has been established and burning on its own controlled air. Close the bypass damper (push in).

B. **Medium Burn Rate:** Partially close air controls (leave open about 1/8"). Close bypass damper (push in). Set the rheostat for fan control halfway between low and high.

C. **High Burn Rate:** Set primary air controls wide open. Have damper closed. Set rheostat for fan control all way on high.

D. **Wood Loading:** During refueling, open (pull out) bypass damper to allow smoke in the firebox to escape - wait a few seconds. Open fuel door, if there happens to be any raw pieces left over place them in the rear East/West direction. Slowly add wood North/South direction, front to back . The door should be open less than one minute, close door and bypass damper. Open primary air control wide open for 5-10 minutes to charge wood, making sure the stove is burning clean and the catalyst is above 900˚ Fahrenheit before shutying down the burn setting.

- After most of wood has burned and if you are not planning on reloading immediately, it may be necessary to open damper bypass, then door, and rake wood and coals into a pile near front center of firebox. (Be certain wood chunks are pulled out of rear corners.) Close door and damper bypass. This step will assure continued combustion and thorough burning of wood.

You will have to experiment with fire rate until you find the particular setting for heating your home. Chimney drafts, tightness of house, doors, windows, insulation in house and atmospheric conditions all influence which setting you must have, so it may take several firings to learn setting necessary for your installation. Heating capacity is based on BTU output and conditions listed above. These conditions will affect heating capability of your heater.

Although catalytic stoves decrease ash residue, routine removal of excess ash is still necessary.

SECTION VI

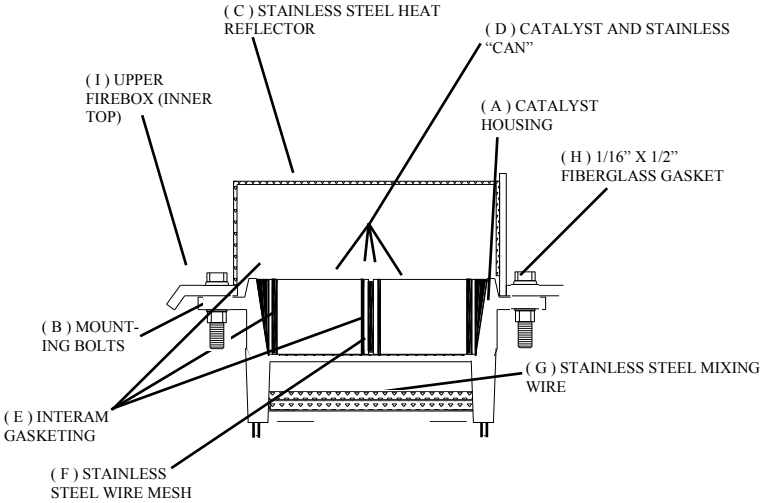
PREVENTIVE MAINTENANCE / PARTS REPLACEMENT
THE CATALYSTS

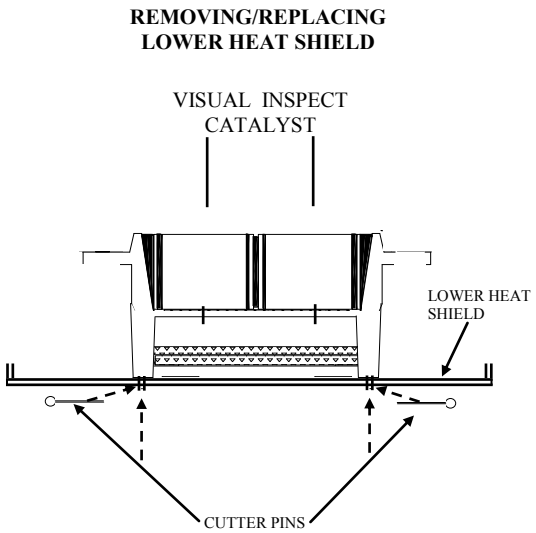
The catalysts in your stove are designed for many years of use. If after several years of use, the efficiency of stove decreases or if a notable amount of smoke is observed, catalysts may need to be replaced. See Catalyst Warranty prior to replacement. The following points are some general guidelines from catalyst manufacturer.

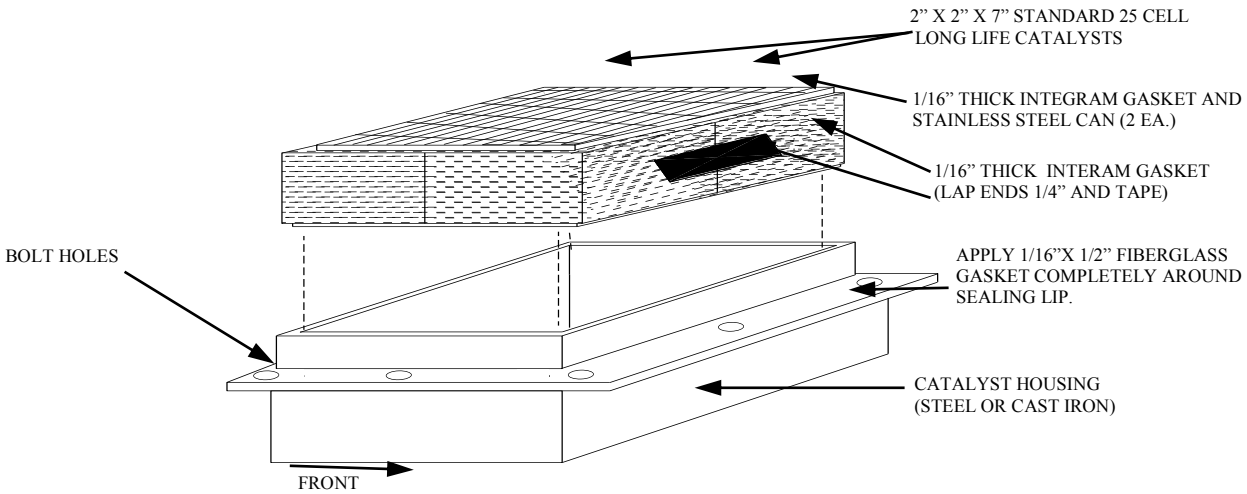
1. Do not "hot fire" stove. For many years retailers and installers have advised customers to build an extra hot fire to burn creosote deposits in fire system. This advice may be acceptable for non-cat stoves, but can be death to a catalyst. Why? Because the catalyst is reducing the particulate, or creosote buildup, therefore need to "hot fire" is eliminated. Proper chimney cleaning procedure should be followed.
2. Direct Flame contact is death to a catalyst. A catalyst burns by-products in the smoke. The gases such as CO, HC, and O^2 ignite with each other in a chemical reaction in presence of the catalyst (while passing through the honeycomb configuration). Direct flame inhibits this reaction by changing chemical make-up of catalyst breaking down substrate or ceramic. This problem is called **flame impingement**. Today's modern stoves are designed so that flame impingement is unlikely. However, a strong, fast draft can pull flame into catalyst. Or, a hot fire, with all air controls and/or the ash door open can literally torch the catalyst. The remedy for hot fire related flame is to advise customers not to "hot fire" the stove. The customer will enjoy their catalysts longer and with better performance if these guidelines are followed. Fly ash problems also can be reduced by controlling draft.
3. The **"Glow" Misconception:** A catalyst can glow during certain stages of combustion. The determination that a catalyst is not working simply because it does not glow is inaccurate. During low burn cycle, when catalyst is doing the bulk of its work, it usually does not glow. Also, extremely dry wood (oak, ash, etc.) can burn clean enough not to produce a glow in converter. In most new stoves, you cannot see catalyst.
4. **Light Off Temperature:** CO conversion in the Applied Ceramics catalyst begins at a very low temperature. Usually, a normal start up to produce a coal bed will produce more than sufficient temperatures to begin catalytic combustion.
5. The catalyst is not consumed or "used up". The nature of a catalytic reaction is defined as follows, by the American Heritage Dictionary, Second College Edition: catalyst "1. Chem. A substance, usually present in small amounts relative to reactants, that modifies and especially increases rate of a chemical reaction without being consumed in process." This means your catalyst is always there. This also means that gases that would normally go out flue system and pollute the environment are being burned to create more heat from less wood.
6. Why does a catalyst stop working? Most catalyst that are returned are either destroyed by flame impingement, broken due to accidents or mishandling or have nothing wrong with them but fly ash build-up. A catalyst can be "saturated" with by-products of wood burning such as potassium. This is chemical saturation. The prohibitive chemical will fill in the chemical "holes" that gases normally use for reaction. This process of saturation can be slowed by regular maintenance of catalyst. Saturation can take several years since there are units in use for over five years. Burning garbage, painted woods or large amounts of colored paper can poison your unit. Poisoning, however, is very difficult to do. Burning colored paper causes more of a fly ash problem than a risk of poisoning. NEVER BURN RUBBER OR PLASTIC.
7. Burn only dried natural seasoned hard wood. Wood should be dried for at least 12 months prior to burning. The wood should be FREE of any moisture such as RAIN or SNOW. Wet wood creates water vapor which can drop the temperature of catalyst. The results can be plugging, clogging and thermal shock to catalyst. When a catalyst has ceased to be effective, you will notice increased fuel usage and your chimney sweep will notice increased creosote in your system. Before you replace unit, review this section. If you find that your catalyst should be replaced, follow instructions for warranty replacement that were provided when your unit was purchased.
8. Cleaning catalyst with plain water can reduce build-up of catalyst-retarding chemicals. Nothing but a soft brush, low pressure air or plain water should be used to clean a catalyst. The ceramic unit is fragile in comparison to rest of the stove, so it should be handled with care. A soak in warm or hot (not boiling) water for 20 minutes is ideal. Then, allow unit to cool at room temperature and rinse under medium pressure under a faucet. Allow unit to thoroughly dry before reinstalling it or you will damage it. Finally, reinstall unit. A cleaning once every year is sufficient for most users. Clean it when you have your flue system cleaned.

CATALYST REPLACEMENT (Off-Season Replacement Recommended)

1. Spread a drop cloth in front of stove.
2. Open door and clean out any ash.
3. You will have to remove lower stainless steel heat shield. Remove the four cutter pins holding shield in place. Lay shield aside.
4. Using penetrating oil, generously lubricate eight (8) bolt threads holding catalyst housing in place. Allow oil to penetrate.
5. **(A).** Using a 9/16" wrench or 9/16" socket, loosen eight (8) nuts and remove catalyst housing (drop down) and place in a suitable work area. **(B).** Nuts holding catalyst are brass. If they strip you will have to order them from dealer. NOTE: DUE NOT REPLACE WITH METAL NUTS.
6. Using needle nose pliers, grasp front edge of stainless steel "cans" which houses catalytic element and pull upward. Reposition pliers to another position and pull upward. Repeat procedure until catalyst can be removed from housing.
7. Using a small putty knife or scraper, remove any gasket that may have adhered to catalyst housing.
8. Now, obtain new catalysts #PO910115C and wrap stainless steel "can" with interam gasket and tape ends together using scotch tape or masking tape. **IMPORTANT**: BEFORE STARTING TO REPLACE CATALYST, contact your dealer and order **INTERAM gasket** and **CATALYST HOUSING** Gasket. Gaskets not covered under warranty. It may take your dealer several days to receive the gaskets.
9. Insert new catalysts into catalytic housing and push down until they are seated on the top of stainless steel wire mesh supports.
10. Reinstall catalyst housing into stove and secure in place with brass nuts.
11. Reinstall lower heat shield with cutter pins.
12. The stove is now ready for use.







MOTOR ASSEMBLY REPLACEMENT

(Motor, Thermostat, Rheostat, Wiring Harness)

1. Unplug heater from 115V AC outlet.

2. To replace motor you must first take bottom cover door off. Do this by removing two screws holding it in place. See Figure 22.

3. Next, you will find a wire screen protecting you from electrical components of this unit. See Figure 23. By looking to right of ash pan, you will find screen cover. There are two screws on left side of screen that hold wire screen in place. Remove two screws holding wire screen and motor assembly to vertical bar. See Figure 23.

4. NOTE: It will be easier to remove motor if you remove wire screen out of the way. Take the control knob and nut from the rheostat that is hooked to the wire screen. Mark and unplug wires from rheostat. Mark and unplug wires from switch. Lay wire screen aside. See Figure 23.

5. To remove motor, mark and unhook wire servicing motor. NOTE: You may remove thermostat to make it easier to work in area. Gently slide motor out and while pulling it out move the back of the motor facing you from right to left in a clockwise motion. See Figure 23.

6. Place new motor over old motor and locate motor bracket in the same location as was on the old motor and mark holes on new motor. Remove motor bracket from old motor, line up with marks on new motor and secure bracket to new motor with screws form original motor assembly.

7. To replace motor, turn motor so that 4"x4" air discharge opening is pointing toward back of stove. The flat part of motor housing is turned up. With the air discharge opening pointing in the 2 o'clock position, start in toward unit. Rotating the back of motor counterclockwise. The air discharge opening of motor housing fits in a cavity in back of unit, that will direct air flow to proper location. Make sure air discharge opening is located firmly in opening. If thermostat was removed, replace thermostat in bracket.

8. Hook up wiring to all components, if you have replaced or unhooked them to rewire motor, rheostat or switch. If you need to see wiring diagram See Page 27, Figure 25 If rheostat was removed, replace rheostat on to screen housing with the nut and replace control knob, reconnect wires to switch.

9. Replace motor and wire cage. Hold motor with bracket and wire cage over holes in vertical bar. Fasten motor bracket and wire cage to bar at same time to vertical bar to right of ash pan. Replace bottom cover door.

10. To replace the thermostat and to remove wire screen, follow steps 1 through 3. Gently push the thermostat up and out of thermostat bracket and replace with new thermostat. Fallow step 8 and 9 to reinstall wire screen. See Figure 21.

11. Plug heater back into a 115V AC outlet.

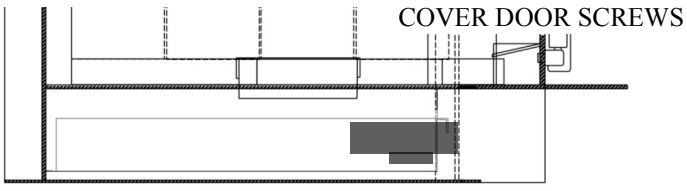


Figure 22

BOTTOM COVER DOOR

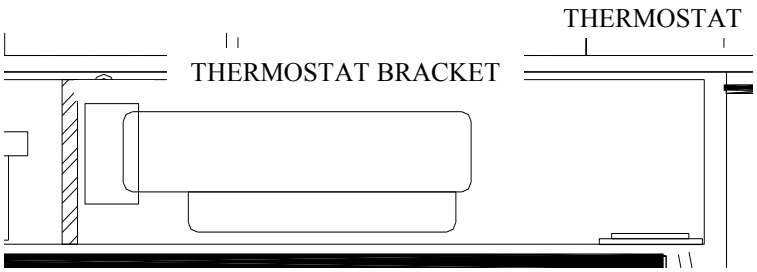


Figure 24

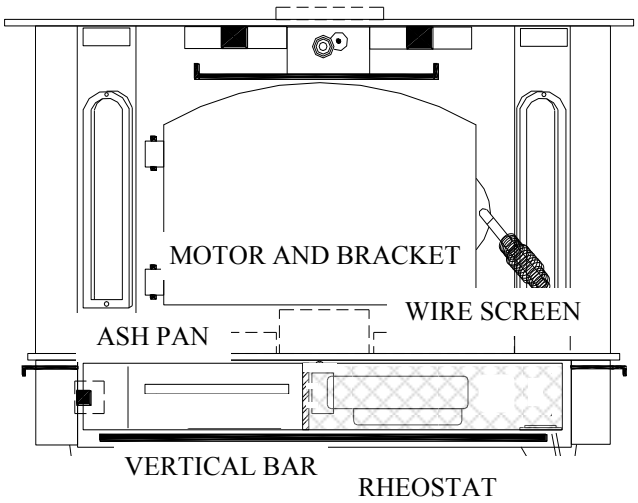
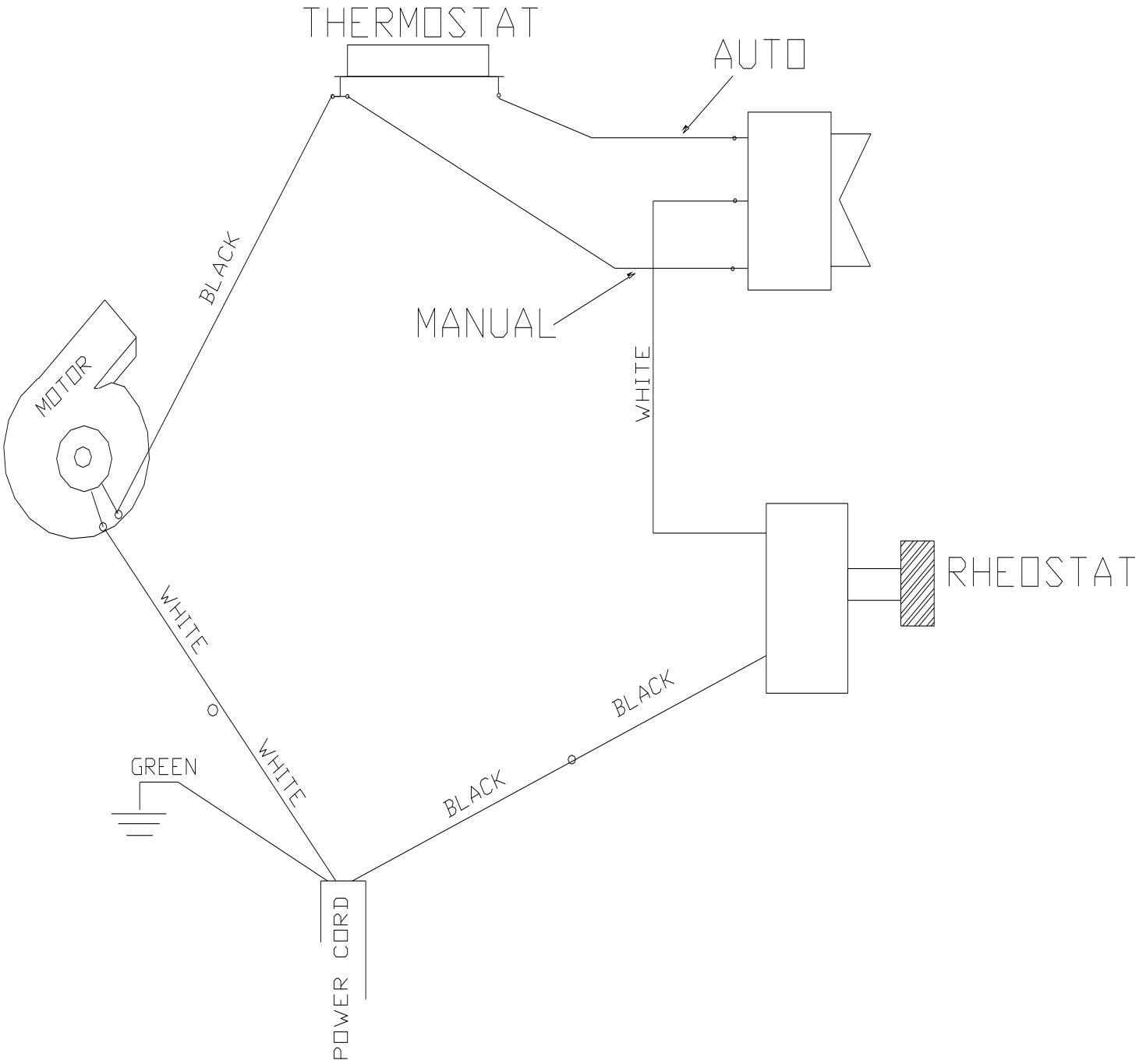


Figure 23

SWITCH

WIRING SCHEMATIC

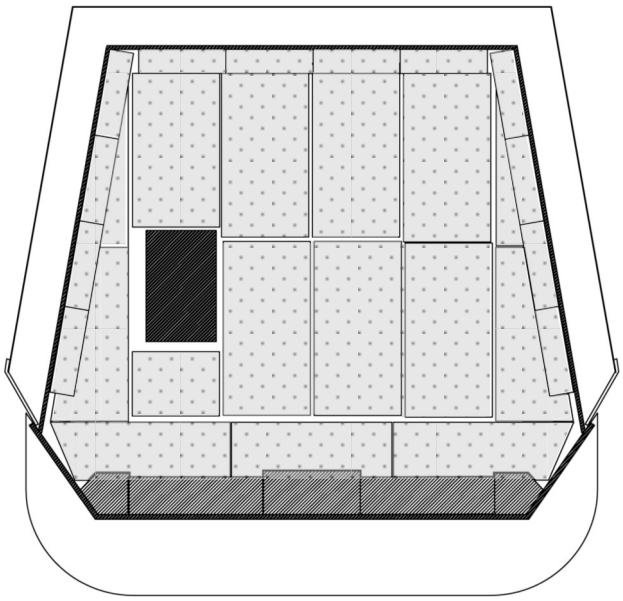
Figure 25



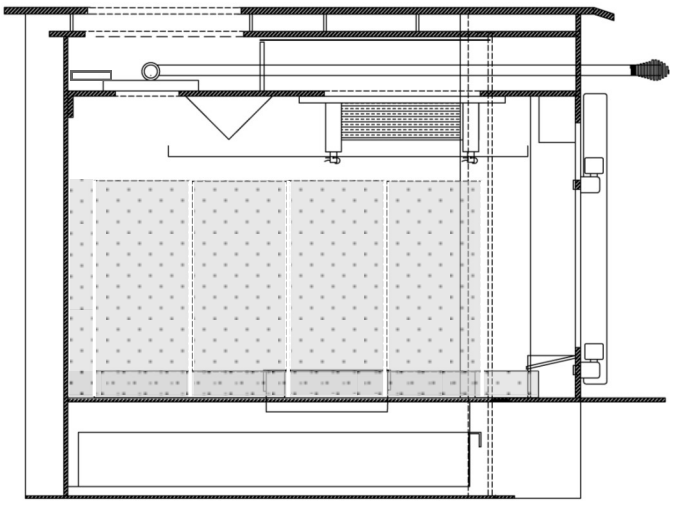
MAINTENANCE

BRICK LAYOUT

TOP VIEW



SIDE VIEW

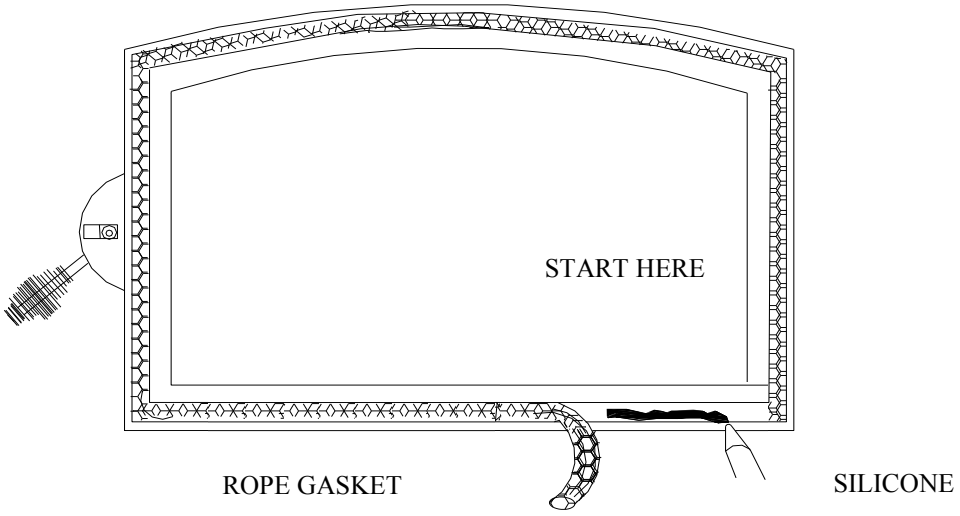


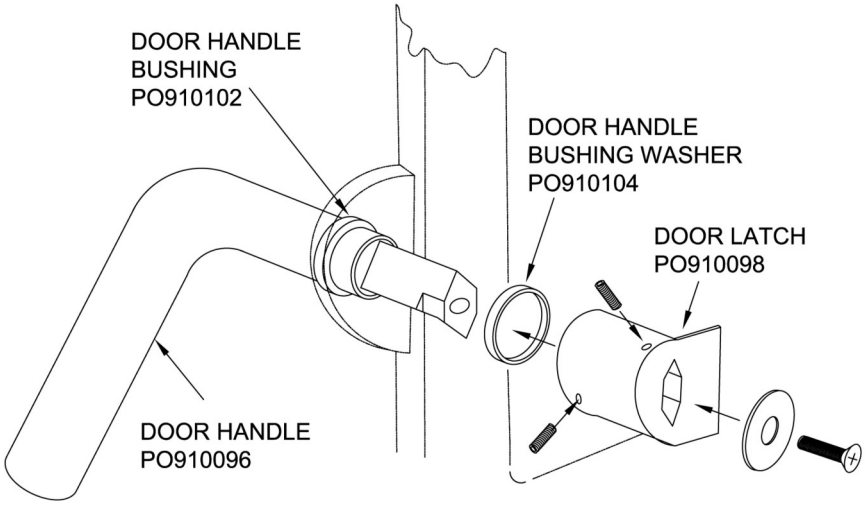
NOTE: “This wood heater contains a catalytic combustor, which needs periodic inspection and repair for proper operation. It is against federal regulations to operate this wood heater in a manner inconsistent with operating instructions in this manual, or if the catalytic element is deactivated or removed”

MAINTENANCE

DOOR GASKET REPLACEMENT (COLD HEATER)

1. To replace deteriorated gaskets, following steps must be taken to ensure proper installation of gaskets.
2.
3. Obtain proper gaskets and silicone glue from your local dealer.
4. Using pliers, remove any worn and deteriorated gaskets.
5. Using a scraper, wire brush and sandpaper or steel wool, clean glue and gasket residue from door frame.
6. Measure and cut gaskets to length. Care should be taken not to stretch gaskets. What you want is a full and loose gasket weave after attachment to framing.
7. Obtain silicone glue and run a 3/16” bead inside door frame.
8. Obtain gasket (s) and place in gasket channel areas starting at lower right corner, See Below. Use a technique which assures that gasket is applied in a loose like manner. DO NOT STRETCH GASKETS.
9. After gasket (s) are applied to glue, use your finger and go over all gasket gently pressing gasket to the channel. Use same pressure against gasket so that final result is an evenly applied gasket.
10. Leave door open and allow at least two (2) hours for glue to dry.
11. Once gaskets are checked, heater is ready for use.
12. This should be done annually. Allowing gaskets to deteriorate can cause over-firing and shorten burn time.





MAINTENANCE
CHECK CHIMNEY

A. Chimney should be inspected twice a year.
B. The chimney should be cleaned as necessary to remove creosote, soot, leaves, birds' nests, etc.

NOTE: A chimney cap should be installed to prevent moisture from entering chimney, to prevent sparks and burning materials from escaping chimney and to keep birds and foreign materials from entering.

NOTE: Some areas may require an approved spark arrestor.

CLEANING THE HEATER

A. The heater should not be cleaned with any type of detergent as most all detergents have an oil base and cannot be painted over.
B. The heater should be lightly sanded with fine sandpaper or steel wool, then repainted or touched up with high temperature paint.
C. If the heater is located in a moist or damp location, check thoroughly for signs of condensation during times when heater is not in use.
D. When heating season is over, heater should be cleaned out completely with a wire brush or cloth to help eliminate ash and burned wood smell.

CARE OF GLASS DOOR

The glass door on your heater permits you to enjoy the beauty of the fire while retaining efficiency of your heater. Although brand of glass used in heater door has well established and recognized heat resistant and strength characteristics, it can be broken through improper care. To achieve maximum utility and safety of your glass door, we advise that you observe following use and safety tips:

1. Inspect glass regularly for cracks or breaks. If you detect a crack or break extinguish fire immediately and return door to your dealer for glass replacement before further use.
2. Do not slam heater door or otherwise impact glass. When closing door, make sure that no logs or other objects protrude to impact against glass.
3. Do not clean glass with materials which may scratch it (such as steel wool) or otherwise damage glass. Scratches on the glass can develop into cracks or breaks.

The glass can be cleaned with a commercial oven cleaner, providing it does not contain abrasives. A build-up on glass that has been there for a considerable length of time can be burned off with a propane torch or straight razor blade. Use protective gloves when using razor.

REPLACEMENT PARTS FOR MODEL 91

	Description	Quantity	Part Number
1.	Door Handle Assembly	1	PA 910096
2.	Door Latch	1	PC 910098
3.	Door Handle Washer	1	PH316916FW
4.	Front Door Bushing	1	PO 910102
5.	Door Handle Bushing Washer	1	PO910104
6.	Door Black	1	PA 912651B
6.	Door Gold	1	PA 912651G
7.	Door Pewter	1	PA 912651P
8.	Carling Fan Auto/Man Switch	1	PE RC211RB
9.	Thermostat 110° Disc	1	PE 400132
10.	Power Cord	1	PE 400240
11.	Strain Relief	1	PE 400320
12.	Motor	1	PE 910714
13.	Rheostat	1	PE BC204
14.	Rheostat Knob	1	PE BC204A
15.	Glass	1	PG 265191GL
16.	Glass (Bay Side)	2	PG 27BSGL
17.	Bay Glass Overlay Black	2	PO 910454
18.	Bay Glass Overlay Gold	2	PO 910454G
19.	Bay Glass Overlay Pewter	2	PO 910454P
20.	Glass Clip	1	PO 912651
21.	Glass Clip Screws	1	PH 103238HWHS
22.	Large Spring Handle For Door	1	PO 100150B
23.	Small Spring Handle For Damper	1	POBC290B
24.	Sot Gun Air Rod	1	MF 910088
26.	Primary Air Rod	1	MF 910092
27.	Bottom Cover Door	1	MA91COVDOOR
28.	Catalyst Housing	1	PCH91
29.	Catalyst Housing Gasket Intergram 1/16”	1	PO910500
30.	Damper Rod	1	PO910012
31.	Lower Heat Shield	1	PS910011
32.	Catalyst Mixing Wire	1	PS910015
33.	Motor Guard Screen	1	PS 910105
34.	1” X 1” X 1/8” Thick Magnet	2	PODM841
35.	Fire Brick	16	PR900050
36.	Catalyst		PO910115C

SECTION VII

TROUBLESHOOTING

Operation of any wood heater can create problems. While use of a catalytic-combustor equipped stove will substantially lessen some of these problems– such as creosote formation– other traditional wood heater problems may remain.

The following guidelines apply to operation of all wood heaters, with problems related to catalytic heater addressed where appropriate.

HEATER RELATED PROBLEMS

Problem	Possible Cause	Solution
1. Sluggish Heater Performance	1. Obstruction in chimney	1. Check cap and chimney and remove obstruction.
	2. Improperly sealed trim kit or direct connect kit	2. Check trim kit gasket or direct connect kit seal to fireplace and gasket as necessary to seal unit. Gasket under stove if needed. Check seal or direct connect and correct
	3. Manual damper in chimney is closed	3. Open manual damper and wire shut with stainless steel wire or remove damper
	4. Closing bypass or exhaust damper too soon	4. Follow **New Buck** instructions for proper firing procedures
	5. Poor chimney draft	5. Flue may need extension. Oversized flue may need direct connect or positive liner.
	6. Combustor is plugged	6. See section in "Combustor Related Problems"
	7. Wet or unseasoned wood being burned	7. Burn dry, natural seasoned hard wood
2. High Fuel Consumption	1. Inexperience in catalytic operation	1. Operate stove with desired heat output in mind. Do not be overly concerned with maintaining light-off temperatures
	2. Improper regulation of draft or inlet air	2. Close inlet air control as much as possible to maintain desired heat output. Check gaskets, reinstall fiberglass gasketing around doors and glass as necessary
	3. Air leaking around door frame and/or glass	3. Check door gasket. Check adjustment of door latch.
	4. Bypass damper open	4. Close bypass damper

3. Backpuffing	1. Gusts of wind / windy day 2. Hot combustor. (Above 1400^{o} F)	1. If flue cap not on chimney, install one. 2. Increase the amount of combustion air slowly
4. Smoke Rollout when Heater Door is Opened	1. Bypass damper is closed 2. Opened door too soon after opening bypass damper 3. Wind gusts blowing	1. Open bypass damper 2. Open bypass damper– wait 15 -30 seconds before slowly opening door 3. Install flue cap
5. Low Catalytic Temperature	1. Bypass is open 2. Light-off not obtained 3. Fuel charge is spend 4. Combustor coated with fly ash or soot 5. Heater damper down too much	1. Once light-off temperatures have been reached and unit is stabilized, close bypass 2. Follow manufacturer's operating instructions 3. Refuel as necessary for combustor operation 4. See Section VII "Preventive Maintenance" 5. Ensure that proper air mixture and draft are available for wood to burn proper
COMBUSTOR-RELATED PROBLEMS		
1. Plugging	1. Burning materials that produce a lot of char and fly ash 2. Burning wet, pitchy wood or burning large loads of small-diameter wood with the combustor in the operating position without light-off taking place	1. Do not burn materials such as garbage, gift wrap or cardboard 2. Burn dry, natural seasoned hard wood. Don't place the combustor in the operating position until high temperatures are high enough to initiate light-off
2. Catalyst Peeling	1. Extreme temperatures at combustor surface can cause the catalyst to peel. Over-firing and flame impingement are primary causes	1. If severe, remove and replace catalysts. See "Catalyst Replacement" Section VI. Avoid extreme temperatures
3. Catalyst Masking	1. Not maintaining light-off temperatures	1. See Section VI and review operating instruction.
COLORED-GLASS PROBLEMS		
1. Glass Darkens	1. Buildup Creosote on Glass	1. Cleaning Glass. The glass inside will become colored during use from creosote buildup. The best way to clean glass, COLD STOVE, is to let creosote buildup harden. Then use razor blade to scarp of buildup of creosote. Wash glass using soppy water or glass cleaner.

NEW BUCK CORPORATION (NBC)
"LIMITED WARRANTY" FOR NBC RELATED PRODUCTS

PLEASE READ THIS WARRANTY CAREFULLY
PRODUCTS COVERED

This warranty covers heating unit so long as it is owned by original purchaser, including optional and standard accessories purchased at same time, subject to terms, limitations and conditions herein set out.

PRODUCTS NOT COVERED
This warranty does not cover the following:
Glass, Refractory Material, Firebrick, Gaskets or Catalyst.
Catalyst is warranted by Applied Ceramic Inc. 5555 Pleasantdale Road Doraville, Ga. 30340 (770)448-6888

This warranty will not cover any damage and/or failure caused by abuse or improper installation of products covered.

WARRANTY TIME PERIODS

(A) Period I
For one (1) year from date of purchase, NBC will replace or repair, at its option, any part defective in materials or workmanship. The costs of parts only are included. The customer pays any labor or transportation charges required.

Thereafter

(B) Period II
For period after the first (5) year from the date of purchase and extending for five (5) years as long as related product is owned by original purchaser, NBC will repair or replace at its option, any part defective in materials or workmanship, with exception of: electrical motors, wiring, switches, components, optional and standard accessories and all parts not permanently attached to heating unit. Parts not permanently attached to heating unit are defined as those items designed to be removed from unit, including those removable with common hand tools. The cost of parts only are included. The customer pays any labor or transportation charges required.

PROCEDURE
Should you feel that your **heater** is defective, you should contact any NBC dealer for name of your nearest authorized heater service representative, who will instruct you on proper procedure, depending on which Warranty Time Period (Period I or Period II) applies.

If for any reason you are dissatisfied with the suggested procedures, you may contact us in writing at:

NEW BUCK CORPORATION
Customer Service Department
P. O. Box 69
Spruce Pine, NC 28777

CONDITIONS AND EXCLUSIONS

(A) Replacement of parts may be in form of new or fully reconditioned parts, at NBC's option.
(B) There are no other warranties express or implied including warranties of Merchantability, Fitness for Purpose or Otherwise except those warranties expressly stated herein.
(C) **New Buck Corporation** is not liable for indirect, incidental or consequential damages in connection with the use of the product including any cost or expense or providing substitute equipment or service during periods of mal-function or non-use. Some states do not allow exclusion of incidental or consequential damages, so the above exclusion may not apply to you.
(D) All warranty repairs under this warranty must be performed by an authorized Buck Stove service representative. Repairs or attempted repairs by anyone other than an authorized service representative are not covered under this warranty. In addition, these unauthorized repairs may result in additional malfunctions, correction of which is not covered by warranty.

OTHER RIGHTS
This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state.

OWNER REGISTRATION CARD
The attached Owner Registration Card must be completed in its entirety and mailed within 30 days from date of purchase or from date of installation, if installed by a factory certified installer, to New Buck Corporation, in order for warranty coverage to begin.

PLEASE NOTE: The Owner Registration Card must contain the Authorized Dealer Code Number and the Certified Installer's number (if applicable) for warranty coverage to begin.

To be completed by selling distributor/ dealer/ customer:

OWNER REGISTRATION CARD

Name _____
(Last) (First)
Address _____

City _____ State _____ Zip_____

CUSTOMER EMAIL::_____

Model 91 Bay _____ Insert: Residential _____
Model 91 Bay _____ Freestanding: Residential _____

Serial No. _____

Date of Installation: Day _____ Month _____ Year _____

Installer's Name _____ Certification No. _____

Dealer Name _____

City _____ State _____

Dealer No. _____

Distributor Name _____

Distributor No. _____

Is appliance customer self-installed? Yes _____ No _____

Has appliance been completely checked out? Yes _____ No _____

Has customer been given appliance and operation orientation? Yes _____ No _____

_____ a) Damper/Door Vents
_____ b) Door-Handle/ Removing
_____ c) Thermostat-Normal Operation
_____ d) Hot Surface Area
_____ e) Speed Control (Rheostat)
_____ f) Switch—Manual/Off/Auto
_____ g) Paint Curing
_____ h) Chimney Safety
_____ i) Rain Cap
_____ j) Wood Preparation
_____ k) Installation
_____ l) Instructions & Clearances - Self-Installation

Has customer been given **WARRANTY REVIEW?** Yes _____ No _____

CUSTOMER SIGNATURE _____
New Buck Review
DATE _____

Mail to:

NEW BUCK CORPORATION
P.O. Box 69
200 Ethan Allen Dr.
Spruce Pine, NC 28777
Email: info@buckstove.com

Appendix B
Alt-125 E3053 Letter

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

FEB 2 8 2018

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

Mr. Justin White
Hearthstone QHPP, Inc.
#17 Stafford Ave.
Morrisville, VT 05661

Dear Mr. White,

I am writing in response to your letter dated January 12, 2018, regarding wood heaters manufactured by Hearthstone QHPP, Inc. (Hearthstone). This response, dated February 28, 2018, supercedes our previous response (dated February 26, 2018) to correct an inaccuracy regarding required changes to ASTM E3053-17.

You are requesting to use an alternative test method, using cord wood, as referenced in section 60.532(c) of 40 CFR part 60, Subpart AAA, Standards of Performance for New Residential Wood Heaters (Subpart AAA) to meet the 2020 cord wood alternative compliance option. The 2020 cord wood alternative compliance option states that each affected wood heater manufactured or sold at retail for use in the United States on or after May 15, 2020, must not discharge into the atmosphere any gases that contain particulate matter in excess of 2.5 g/hr. Compliance must be determined by a cord wood test method approved by the Administrator along with the procedures in 40 CFR 60.534. You have requested approval to use the procedures and specifications found in ASTM Method E3053-17, a cord wood test method titled, "Standard Test Method for Determining Particulate Matter Emissions from Wood Heaters using Cordwood Test Fuel," in conjunction with ASTM E2515-11 and Canadian Standards Administration (CSA) Method CSA-B415.1-10, which are specified in 40 CFR 60.534.

We understand that Hearthstone is also requesting that the alternative method proposed above be approved to apply broadly to all wood heaters manufactured by Hearthstone meeting the requirements of Subpart AAA, from the approval date of this request until such time that Subpart AAA is revised or replaced to require a different cord wood certification method, providing all requirements of section 60.533 of Subpart AAA are met.

With the caveats set forth below, we approve your alternative test method request for certifying wood heaters using ASTM E3053-17 in conjunction with section 60.534 of Subpart AAA to meet the 2020 cord wood compliance option until such time that Subpart AAA is revised or replaced to require a different cord wood certification method. We also approve application of this alternative method to all wood heaters manufactured by Hearthstone meeting the requirements of Subpart AAA.

As required in Subpart AAA, section 60.354(d), you or your approved test laboratory must also measure the first hour of particulate matter emissions for each test run using a separate filter in one of the two parallel sampling trains. These results must be reported separately and also included in the total particulate matter emissions per run. Also, as required by Subpart AAA, section 60.534(e), you must have your approved laboratory measure the efficiency, heat output, and carbon monoxide emissions of the tested wood heater using CSA-B415.1-10. For measurement of particulate matter emission concentrations, ASTM 2515-11 must be used.

The following change to ASTM E3053-17 must be followed:

1. Coal bed conditions prior to loading test fuel. The coal bed shall be a level plane without valleys or ridges for all test runs in the high, low, and medium burn rate categories.

The following changes to ASTM E2515-11 must be followed:

1. The filter temperature must be maintained between 80 and 90 degrees F during testing.

2. Filters must be weighed in pairs to reduce weighing error propagation; see ASTM 2515-11, Section 10.2.1 Analytical Procedure.

3. Sample filters must be Pall TX-40 or equivalent Teflon-coated glass fiber, and of 47 mm, 90 mm, 100 mm, or 110 mm in diameter.

4. Only one point is allowed outside the +/- 10 percent proportionality range per test run.

A copy of this letter must be included in each certification test report where this alternative test method is utilized.

It is reasonable that this alternative test method approval be broadly applicable to all wood heaters subject to the requirements of 40 CFR part 60, Subpart AAA. For this reason, we will post this letter as ALT-125 on our website at *http://www3.epa.gov/ttn/emc/approalt.html* for use by other interested parties. As noted earlier in this letter, this alternative method approval is valid until such time that Subpart AAA is revised or replaced to require a different cord wood certification method, and at such time, this alternative will be reconsidered and possibly withdrawn.

If you have additional questions regarding this approval, please contact Michael Toney of my staff at 919-541-5247 or toney.mike@epa.gov.

Sincerely,

Steffan M. Johnson, Group Leader
Measurement Technology Group

cc: Amanda Aldridge, EPA/OAQPS/OID
Adam Baumgart-Getz, EPA/OAQPS/OID
Rafael Sanchez, EPA/OECA
Michael Toney, EPA/OAQPS/AQAD