
New Buck Corporation

Project # 037-S-048-6 B

Model: 21NC

Type: Free Standing Residential
Non-catalytic Wood Fired Heater

September 16, 2016

Test Method 28R for Certification and Auditing of Wood Heaters

Contact:

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Affidavit:

Dirigo Laboratories, Inc. was contracted by New Buck Corporation, Inc. to provide testing services for the Model 21NC – free standing wood fired heater per EPA Method 28R for Certification and Auditing of Wood Heaters. All testing and associated procedures were conducted at Dirigo Laboratories, Inc. beginning on 8/9/2016 and ending on 8/16/2016. Dirigo Laboratories is located at 11785 SE Highway 212 – Suite 305, Clackamas, Oregon 97015. Testing procedures followed EPA Method 28R and ASTM E2780-10. Particulate sampling was performed per ASTM E2515-10 *Standard Test Method for Determination of Particulate Matter Emissions Collected by a Dilution Tunnel*.

Dirigo Laboratories is accredited by the U.S. Environmental Protection Agency for the certification and auditing of wood heaters pursuant to subpart AAA of 40 CFR Part 60, New Source Performance Standards for Residential Wood Heaters and subpart QQQQ of 40 CFR Part 60, Standards of Performance for New Hydronic Heaters and Forced Air Furnaces, Methods 28R, 28WHH, 28 WHH-PTS, and all methods listed in Sections 60.534 and 60.5476. Dirigo holds EPA Accreditation Certificate Numbers 4 and 4M (mobile). Dirigo Laboratories, Inc. is accredited by A2LA to ISO 17020:2012 “Criteria for Bodies Performing Inspections”, ISO 17025:2005 “Requirements for Testing Laboratories”, and ISO 17065:2012 “Requirements for Bodies Operating Product Certification Systems”. Dirigo holds A2LA Certificate Numbers 3726.01, 3726.02, and 3726.03. See Appendix E for Accreditations.

The following people were associated with the testing, analysis and report writing associated with this project.

John Steinert, President

Gary Nelke, CMfgE

Doug Towne, QA Manager

Introduction:

New Buck Corporation, Inc. of Spruce Pine, NC, contracted with Dirigo Laboratories, Inc. to perform EPA certification testing on their Model 21NC free standing non-catalytic wood heater. All testing was performed at Dirigo Laboratories, Inc. Testing was performed by Mr. Gary Nelke CMfgE.

Notes:

- A 48 hour break-in was performed on the appliance at Dirigo Laboratories, Inc. Data is provided in separate electronic folder.
- Prior to testing, the dilution tunnel was cleaned with a steel brush.
- Run #'s 1, 2, 3 & 4 were performed with the convection blower in operation. Run #5 was the blower confirmation run and was performed with the convection blower off.
- Front filters were changed on sample train A at one hour for all runs.

Wood Heater Identification and Testing:

- Appliance Tested: **Model 21NC**
- Serial Number: **012176**
- Manufacturer: **New Buck Corporation, Inc.**
- Catalyst: **No**
- Heat exchange blower: **Optional**
- Type: **Wood Stove**
- Style: **Free Standing**
- Date Received: **Thursday, May 19, 2016**
- Wood Heater Aging: **July 5-14, 2016**
- Testing Period – Start: **Tuesday, August 09, 2016** Finish: **Tuesday, August 16, 2016**
- Test Location: **Dirigo Laboratories, Inc. 11785 SE HWY 212 - Suite 305, Clackamas, OR 97015**
- Elevation: **≈131 Feet above sea level**
- Test Technician(s): **Gary Nelke**
- Observers: **NA**

Test Procedures and Equipment:

All Sampling and analytical procedures were performed by Gary Nelke. All procedures used were directly from EPA Method 28R, ASTM E2780-10 and ASTM E2515-10. See the list below for equipment used. See Appendix D for calibration data.

Equipment List:

1. Analyzer -California Analytical ZRE CO2/CO/O2 IR ANALYZER
2. Delmhorst J-2000 Wood Moisture Meter
3. Dayton 4c121 Blower for dilution tunnel -Emissions Booth #1
4. ScienTech Balance Scale
5. 10 lb Calibration Weight
6. DigiWeigh Bench Shipping Scale
7. APEX XC-60 Digital Emissions Sampling Box A
8. APEX XC-60 Digital Emissions Sampling Box B
9. APEX Ambient sampling box
10. Gast MOA-P122-AA Vacuum Pump
11. Rice Lake 3'x3' floor scale w/digital weight indicator

Results:

The weighted average emission rate is **1.7 g/hr** with a weighted average efficiency of **70.5%**. The New Buck Corporation, Inc. Model 21NC non-catalytic wood stove meets the 2020 PM emission standard of ≤ 2.0 g/hr per CFR 40 part 60, §60.532 (b).

Detailed individual run data can be found in separate digital folders supplied with this report.

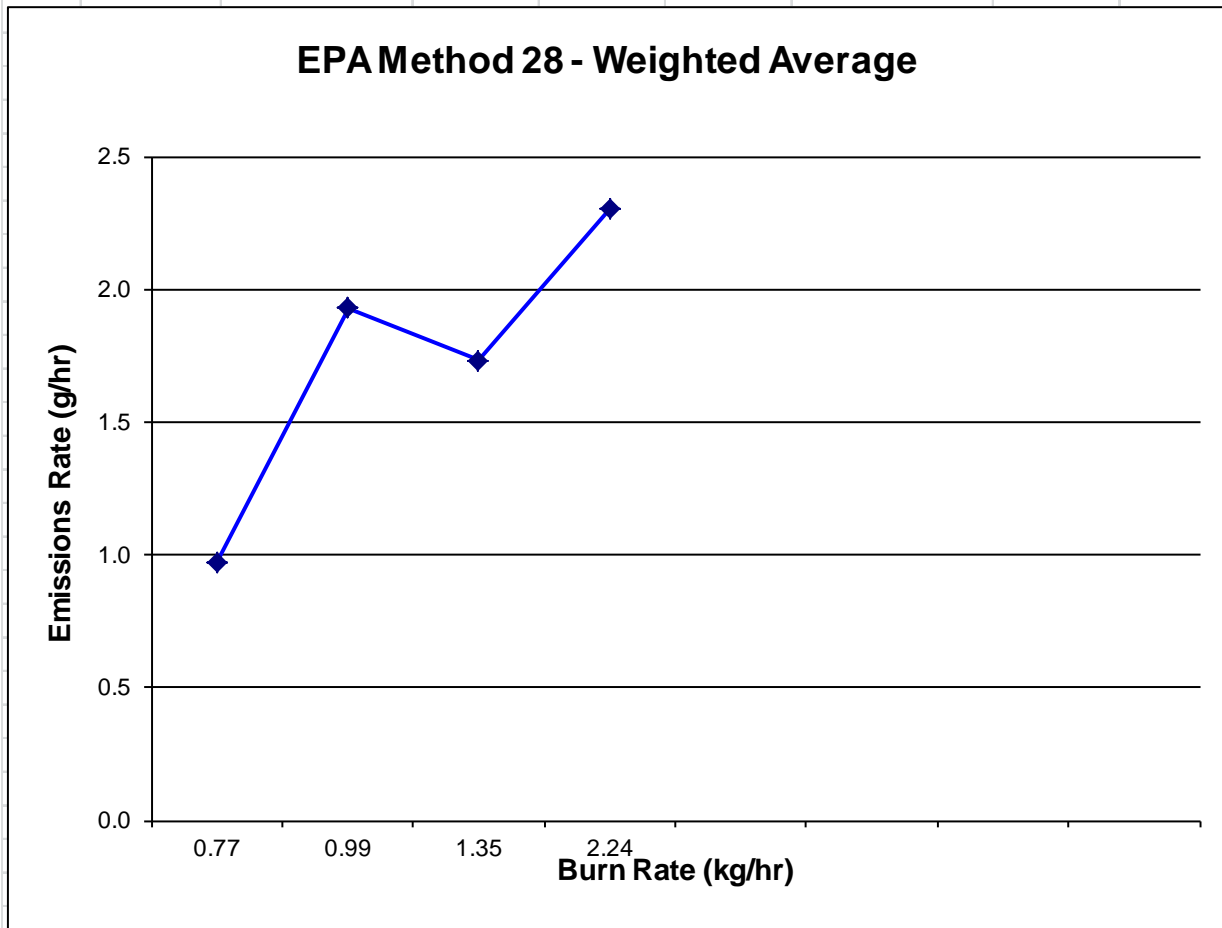
Emissions:

DIRIGO LABORATORIES INC.				EPA Method 28 - Weighted Average			
Weighted Average:				1.7	(g/hr)		
Client:	New Buck Corporation						
Model:	21NC						
Tracking No.:	48						
Project No.:	037-S-048-6 B						
Test Dates:	8/9/16 - 8/16/16						
Burn Rate Category	1			Burn Rate Category	2		
Burn Rate (kg/hr-dry)	0.77			Burn Rate (kg/hr-dry)	0.99		
Emissions Rate (g/hr)	1.0			Emissions Rate (g/hr)	1.9		
Emissions Rate Cap (g/hr)	15			Emissions Rate Cap (g/hr)	15		
Weighting Factor	21.24%			Weighting Factor	26.15%		
Run Number	1			Run Number	2		
Burn Rate Category	3			Burn Rate Category	4		
Burn Rate (kg/hr-dry)	1.35			Burn Rate (kg/hr-dry)	2.24		
Emissions Rate (g/hr)	1.7			Emissions Rate (g/hr)	2.3		
Emissions Rate Cap (g/hr)	15			Emissions Rate Cap (g/hr)	18		
Weighting Factor	32.73%			Weighting Factor	19.88%		
Run Number	3			Run Number	4		

EPA Method 28 - Weighted Average




Client: New Buck Corporation
Model: 21NC
Tracking No.: 48
Project No.: 037-S-048-6 B
Test Dates: 8/9/16 - 8/16/16



Efficiency:

All efficiency values use the HHV.

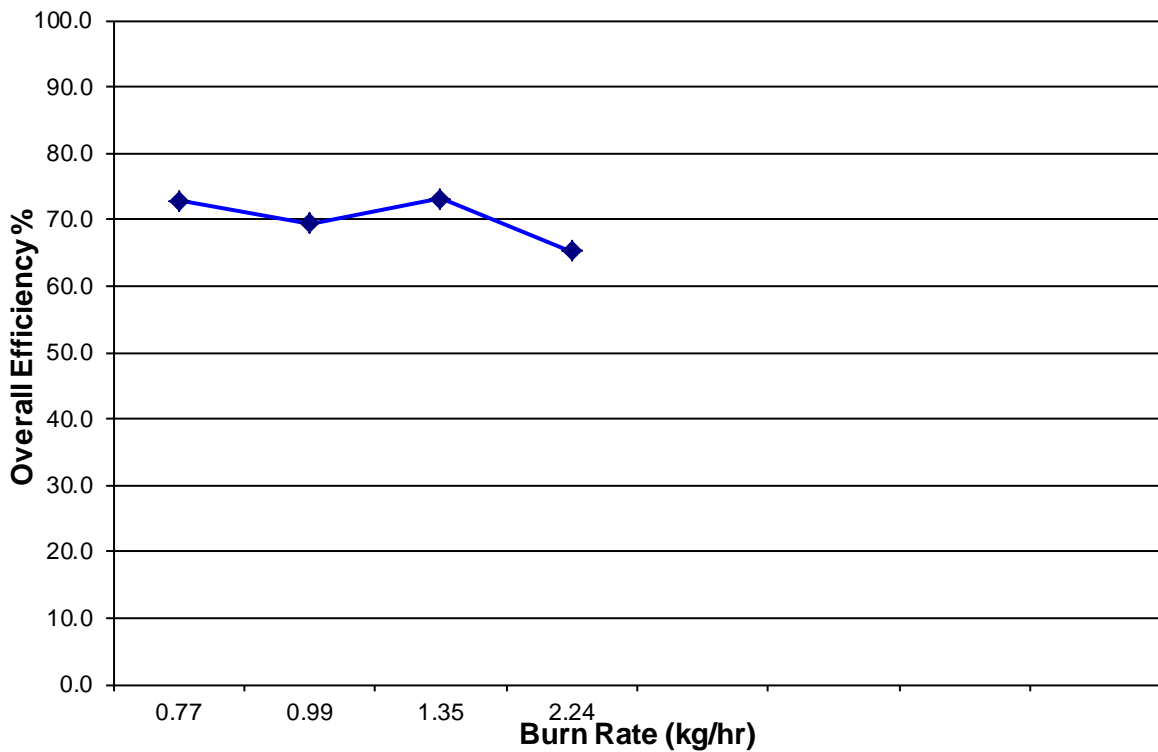
CSA B415.1-10 Weighted Average			
			
Weighted Average: 70.5 %			
Client:	New Buck Corporation		
Model:	21NC		
Tracking No.:	48		
Project No.:	037-S-048-6 B		
Test Dates:	8/9/16 - 8/16/16		
Burn Rate Category	1	Burn Rate Category	2
Burn Rate (kg/hr-dry)	0.77	Burn Rate (kg/hr-dry)	0.99
OA Efficiency %	72.9	OA Efficiency %	69.4
Emissions Rate Cap (g/hr)	15	Emissions Rate Cap (g/hr)	15
Weighting Factor	21.24%	Weighting Factor	26.15%
Run Number	1	Run Number	2
Burn Rate Category	3	Burn Rate Category	4
Burn Rate (kg/hr-dry)	1.35	Burn Rate (kg/hr-dry)	2.24
OA Efficiency %	73.1	OA Efficiency %	65.2
Emissions Rate Cap (g/hr)	15	Emissions Rate Cap (g/hr)	18
Weighting Factor	32.73%	Weighting Factor	19.88%
Run Number	3	Run Number	4

CSA B415.1-10 - Weighted Average



Client: New Buck Corporation
 Model: 21NC
 Tracking No.: 48
 Project No.: 037-S-048-6 B
 Test Dates: 8/9/16 - 8/16/16

EPA Method 28 - Weighted Average



Summary Table:

Category 1 < 0.80 kg/hr		Category 2 0.80 to 1.25 kg/hr		Category 3 1.25 to 1.90 kg/hr		Category 4 Maximum	
Run Number	1	Run Number	2	Run Number	3	Run Number	4
Emissions Rate g/hr	0.97	Emissions Rate g/hr	1.93	Emissions Rate g/hr	1.73	Emissions Rate g/hr	2.30
Burn Rate kg/hr	0.77	Burn Rate kg/hr	0.99	Burn Rate kg/hr	1.35	Burn Rate kg/hr	2.24
BTU/hr (HHV)	11,079	BTU/hr (HHV)	13,648	BTU/hr (HHV)	19,504	BTU/hr (HHV)	28,901
CO g/hr	83.97	CO g/hr	119.82	CO g/hr	93.88	CO g/hr	69.46
OA Efficiency (HHV)	72.9%	OA Efficiency (HHV)	69.4%	OA Efficiency (HHV)	73.1%	OA Efficiency (HHV)	65.2%

Run 1:

Run 1 was a category I burn rate performed on 8/09/16. The test duration was 4 hours 30 minutes. The fuel weight was 9.2 lbs. There was an average particulate emissions rate of 0.97 g/hr. The run had an overall efficiency of 72.9%. The A filter was changed at 1 hr. The 1-hour filter catch was 3.5 mg. All test results were appropriate and valid. The burn rate category was achieved. There were no anomalies and all criteria were met.

Run 2:

Run 2 was a category II burn rate performed on 8/10/16. The test duration was 3 hours 40 minutes. The fuel weight was 9.6 lbs. There was an average particulate emissions rate of 1.93 g/hr. The run had an overall efficiency of 69.4%. The A filter was changed at 1 hr. The 1-hour filter catch was 6.0 mg. All test results were appropriate and valid. The burn rate category was achieved. There were no anomalies and all criteria were met.

Run 3:

Run 3 was a category III burn rate performed on 8/11/16. The test duration was 2 hours 30 minutes. The fuel weight was 9.0 lbs. There was an average particulate emissions rate of 1.73 g/hr. The run had an overall efficiency of 73.1%. The A filter was changed at 1 hr. The 1-hour filter catch was 3.7 mg. All test results were appropriate and valid.

The burn rate category was achieved. There were no anomalies and all criteria were met.

Run 4:

Run 4 was a category IV burn rate performed on 8/12/16. The test duration was 1 hour 30 minutes. The fuel weight was 8.9 lbs. There was an average particulate emissions rate of 2.3 g/hr. The run had an overall efficiency of 65.2%. The A filter was changed at 1 hr. The 1-hour filter catch was 3.5 mg. All test results were appropriate and valid. The burn rate category was achieved. There were no anomalies and all criteria were met.

Run 5:

Run 5 was the fan confirmation run performed on 8/16/16. The test duration was 3 hours 30 minutes. The fuel weight was 9.2 lbs. There was an average particulate emissions rate of 2.52 g/hr. Per Method 28 & ASTM E2515-10 a category II run was performed with the fan in the off position. The emission rate resulting from this test run without the blower operating is equal to or less than the emissions rate plus 1.0 g/h for the test run in the medium burn rate category with the blower operating. Because of this, the wood heater is considered to have the same average emissions rate with or without the blower operating. Additional test runs without the blower operating are unnecessary.

One Hour Particulate Data:

Run Number	Total PM Emissions at 1 hour
1	3.5 mg
2	6.0 mg
3	3.7 mg
4	3.5 mg

Filter Catch:

Run 1:

Project #	037-S-048-6B		MFG	New Buck Corporation	
Run #	1		Model	21NC	
Date	8/16/16				

Train A	Front	Rear	Filter #	Tare	Final	Net	Train B	Front	Rear	Filter #	Tare	Final	Net	
First Hour	<input checked="" type="checkbox"/>		2854	0.1182	0.1217	0.0035		<input checked="" type="checkbox"/>	<input type="checkbox"/>	2856				
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2855					<input type="checkbox"/>	<input checked="" type="checkbox"/>	2857	0.2409	0.2441		
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2859	0.2392	0.2398			<input checked="" type="checkbox"/>	<input type="checkbox"/>	O ring				
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	O Ring			0.0008		<input type="checkbox"/>	<input checked="" type="checkbox"/>	O ring	3.5686	3.5692	0.0038	
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	O Ring	3.5530	3.5532									
						4.3	mg						3.8	mg

Train A	TARE	FINAL	Net
2A	116.2328	116.2319	-0.0009
Train A Total Catch			4.3

Train B	TARE	FINAL	Net
2B	116.3260	116.3260	0.0
Train B Total Catch			3.8

Nozzle	#	TARE	FINAL	Net
2A		116.2328	116.2319	-0.0009
2B		116.3260	116.3260	0.0

Ambient	Filter #	Tare	Final	Net	Vol (liter)
<input checked="" type="checkbox"/>	2858	0.1182	0.1185	0.0003	1509.6
	O ring	1.6485	1.6486	0.0	
	Total			0.0003	mg

Notes: Train A Total: 4.3mg Train B Total: 3.8mg Ambient Total: 0.3mg 1 Hour Catch: 3.5mg

Run 2:

Project #	037-S-048-6B		MFG	New Buck Corporation	
Run #	2		Model	21NC	
Date	8/17/16				

Train A	Front	Rear	Filter #	Tare	Final	Net	Train B	Front	Rear	Filter #	Tare	Final	Net	
First Hour	<input checked="" type="checkbox"/>		2860	0.1166	0.1226	0.0060		<input checked="" type="checkbox"/>	<input type="checkbox"/>	2862				
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2861					<input type="checkbox"/>	<input checked="" type="checkbox"/>	2863	0.2375	0.2438		
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2865	0.2357	0.2361			<input checked="" type="checkbox"/>	<input type="checkbox"/>	O ring				
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	O Ring			0.0005		<input type="checkbox"/>	<input checked="" type="checkbox"/>	O ring	3.5535	3.5539	0.0067	
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	O Ring	3.5893	3.5894									
						6.5	mg						6.7	mg

Train A	TARE	FINAL	Net
3A	116.0687	116.0687	0.0
Train A Total Catch			6.5

Train B	TARE	FINAL	Net
3B	116.3360	116.3360	0.0
Train B Total Catch			6.7

Nozzle	#	TARE	FINAL	Net
3A		116.0687	116.0687	0.0
3B		116.3360	116.3360	0.0

Ambient	Filter #	Tare	Final	Net	Vol (liter)
<input checked="" type="checkbox"/>	2864	0.1206	0.1208	0.0002	1235.09
	O ring	1.6936	1.6938	0.0002	
	Total			0.0004	mg

Notes: Train A Total: 6.5mg Train B Total: 6.7mg Ambient Total: 0.4mg 1 Hour Catch: 6.0mg

Run 3:

Project #	037-S-048-6B		MFG	New Buck Corporation	
Run #	3		Model	21NC	
Date	8/17/16				

Train A	Front	Rear	Filter #	Tare	Final	Net
First Hour	<input checked="" type="checkbox"/>		2866	0.1181	0.1218	0.0037
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2867			
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2871	0.2394	0.2400	
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	O Ring			
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	O Ring	3.5920	3.5920	0.0006
						4.3 mg

Train B	Front	Rear	Filter #	Tare	Final	Net
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2868			
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2869	0.2369	0.2402	
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	O ring			
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	O ring	3.5294	3.5295	0.0034
						3.4 mg

Nozzle	#	TARE	FINAL	Net
4A		116.1803	116.1802	-0.0001
4B		116.3939	116.3939	0.0

Train A Total Catch	4.3
Train B Total Catch	3.4

Ambient	Filter #	Tare	Final	Net	Vol (liter)
<input checked="" type="checkbox"/>	2870	0.1217	0.1216	-0.0001	843.53
	O ring	1.6647	1.6645	-0.0002	
	Total			-0.0003 mg	

Notes: Train A Total: 4.3mg Train B Total: 3.4mg Ambient Total: 0.0mg 1 Hour Catch: 3.7mg

Run 4:

Project #	037-S-048-6B		MFG	New Buck Corporation	
Run #	4		Model	21NC	
Date	8/17/16				

Train A	Front	Rear	Filter #	Tare	Final	Net
First Hour	<input checked="" type="checkbox"/>		2872	0.1180	0.1215	0.0035
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2873			
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2877	0.2369	0.2371	
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	O Ring			
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	O Ring	3.5835	3.5831	0.0002
						3.7 mg

Train B	Front	Rear	Filter #	Tare	Final	Net
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2874			
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2875	0.2389	0.2417	
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	O ring			
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	O ring	3.5691	3.5692	0.0029
						2.9 mg

Nozzle	#	TARE	FINAL	Net
5A		116.7701	116.7701	0.0
5B		116.8783	116.8783	0.0

Train A Total Catch	3.7
Train B Total Catch	2.9

Ambient	Filter #	Tare	Final	Net	Vol (liter)
<input checked="" type="checkbox"/>	2876	0.1217	0.1219	0.0002	501.49
	O ring	1.6697	1.6696	0.0	
	Total			0.0002 mg	

Notes: Train A Total: 3.7mg Train B Total: 2.9mg Ambient Total: 0.2mg 1 Hour Catch: 3.5mg

Run 5 – Fan Confirmation:

Project #	037-S-048-6B		MFG	New Buck Corporation	
Run #	5		Model	21	
Date	8/19/16				

Train A	Front	Rear	Filter #	Tare	Final	Net
First Hour	<input checked="" type="checkbox"/>		2878	0.1195	0.1271	0.0076
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2879			
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2883	0.2429	0.2433	
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	O Ring			
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	O Ring	3.5454	3.5463	0.0013
						8.9 mg

Train B	Front	Rear	Filter #	Tare	Final	Net
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2880			
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2881	0.2412	0.2482	
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	O ring			
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	O ring	3.5970	3.5976	0.0076
						7.6 mg

Nozzle			
#	TARE	FINAL	Net
6A	116.5635	116.5635	0.0
6B	116.1181	116.1181	0.0

Train A Total Catch	8.9
Train B Total Catch	7.6

Ambient <input checked="" type="checkbox"/>	Filter #	Tare	Final	Net	Vol (liter)
	2882	0.1177	0.1177	0.0	1168.995
	O ring	1.6924	1.6927	0.0003	
			Total	0.0003 mg	

Notes: Train A Total: 8.9mg Train B Total: 7.6mg Ambient Total: 0.3mg 1 Hour Catch: 7.6mg

Test Condition Summary:

All testing conditions for all runs fell within allowable specifications of EPA Method 28R, ASTM E2780-10 and ASTM E2515-10. A summary of facility conditions, temperature averages, fuel burned and run times is listed below.

Runs	Ambient (Deg. F)		Barometric Pressure (In. Hg.)	Test Fuel Burned (Lbs.)	Test Fuel Moisture (Dry Basis)	Run Time (Min.)
	Pre	Post				
1	71	77	30.03	9.2	20.9	270
2	75	78	30.04	9.6	19.7	220
3	72	74	30.04	9.0	21.3	150
4	75	78	29.99	8.9	20.4	90

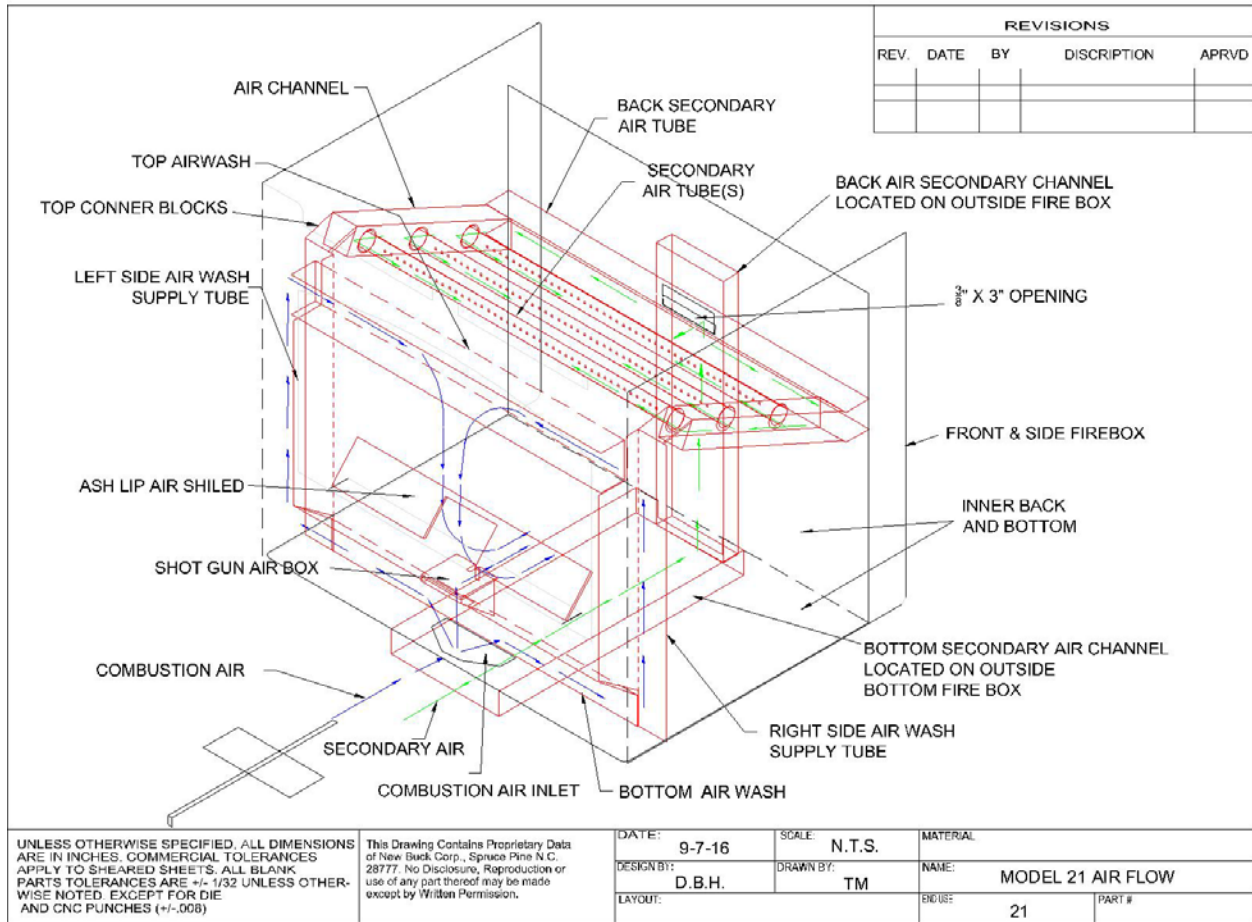
Heater Specifications:

Dimensions, firebox configuration, air supply locations, air introduction locations, and baffle locations of the wood heater are referenced below and on the following page.

Heater Dimensions

Heater Dimensions				
Height	Width	Depth	Firebox Volume	Weight
12.0"	18.5"	10.5"	1.4 ft ³	309 lbs

Air Flow Schematic



Front



Left



Right



Rear



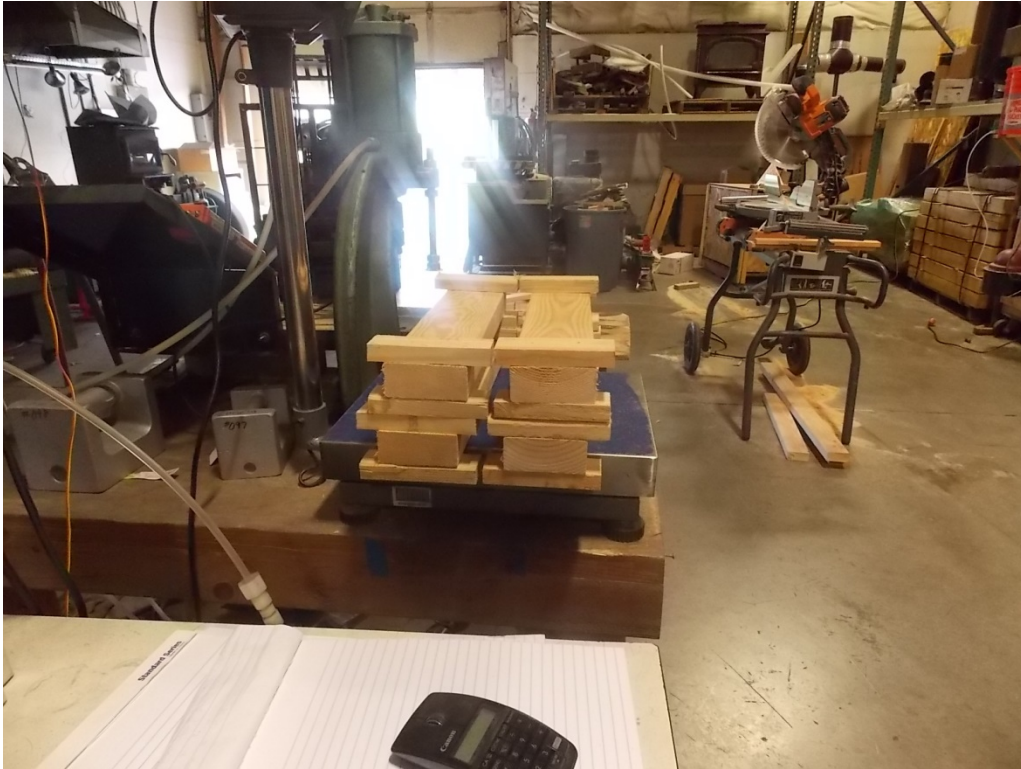
Process Operations and Description:

The appliance was operated according to procedures as described in the Operations Manual. Detailed run information can be found in corresponding digital folders submitted with this report.

Settings & Run Notes

	Run Notes	
	Pre-Burn	Test Run
Run 1	Primary set to $2 \frac{1}{8}$ ". Start at 0840	Category I. Test start: 0952 - Door open 40 seconds, Primary fully open. At 5 mins Primary air set to $2 \frac{1}{8}$ ", fan off. Fan set to low at 1012. Front Filter change at 1052. END test: 1422 – Run time 4.5 hr.
Run 2	Primary set to $2 \frac{1}{16}$ ". Start at 0820	Category II: Test start: 0930 –Door open 30 seconds, Primary fully open. At 5 mins Primary set to $2 \frac{1}{16}$ ", fan off. Fan set to low at 0950. Front filter change at 1030. END Test: 1310 - Run time 3 hr 40 mins.
Run 3	Primary Set to 2". Start at 0840	Category III: Test start: 1002 - Door open 40 seconds, Primary fully open. At 5 mins Primary set to 2", fan off. Fan set to med/high at 1022. Front filter changed at 1102. END test: 1232 - Run time 2.5 hr.
Run 4	Primary fully open. Start at 0830	Category IV: Test start: 0940. Door Open 30 seconds. Primary air fully open. Front filter Change at 1040. Run Time: 1.5 hr.
Run 5	Primary Set to $2 \frac{1}{8}$ ". Start at 1355	Fan Confirmation - Fan OFF. Category II: Test start: 1507. Door open 30 seconds, Primary fully open. At 5 mins Primary air set to $2 \frac{1}{8}$ ", fan off. Change front filter at 1607. END test: 1837 - Run time: 3.5 hr.

Test Fuel Properties:

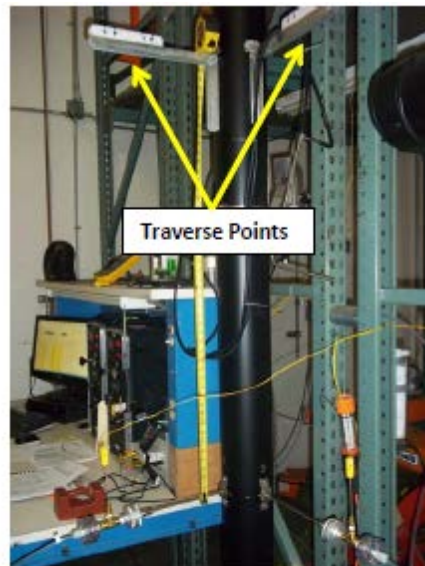
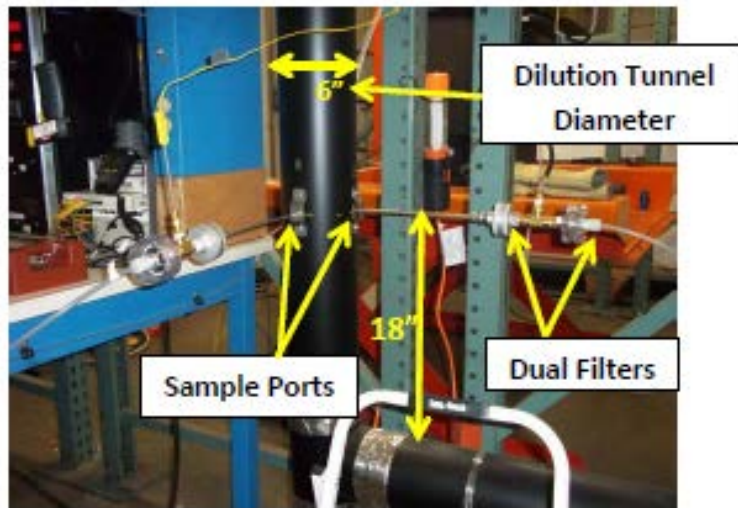


Fuel consisted of 2"x4"x16" Green, Douglas fir. Detailed fuel load specifications for each run can be found in the corresponding digital folders submitted with this report.

Sampling Locations and Descriptions:

Sample ports are located 16.5 feet downstream from any disturbances and 1 foot upstream from any disturbances. Flow rate traverse data was collected 12 feet downstream from any disturbances and 5.5 feet upstream from any disturbances. (See below)

Sample Points



Sampling Methods:

EPA ASTM E2515-11 was used in collecting particulate samples. The dilution tunnel is 6 inches in diameter. All sampling conditions per ASTM E2515-11 were followed. No alternate procedures were used.

Analytical Methods Description:

All sample recovery and analysis procedures followed EPA ASTM E2515-11 procedures. At the end of each test run, filters and probes were removed from their housings, dessicated for 24 hours, and then weighed at 6 hour intervals to a constant weight per ASTM E2515-11 section 11.0.

Calibration, Quality Control and Assurances:

Calibration procedures and results were conducted per EPA Method 28R, ASTM E2515-11 and ASTM E2780-10. Test method quality control procedures (leak checks, volume meter checks, stratification checks, proportionality results) followed the procedures outlined.

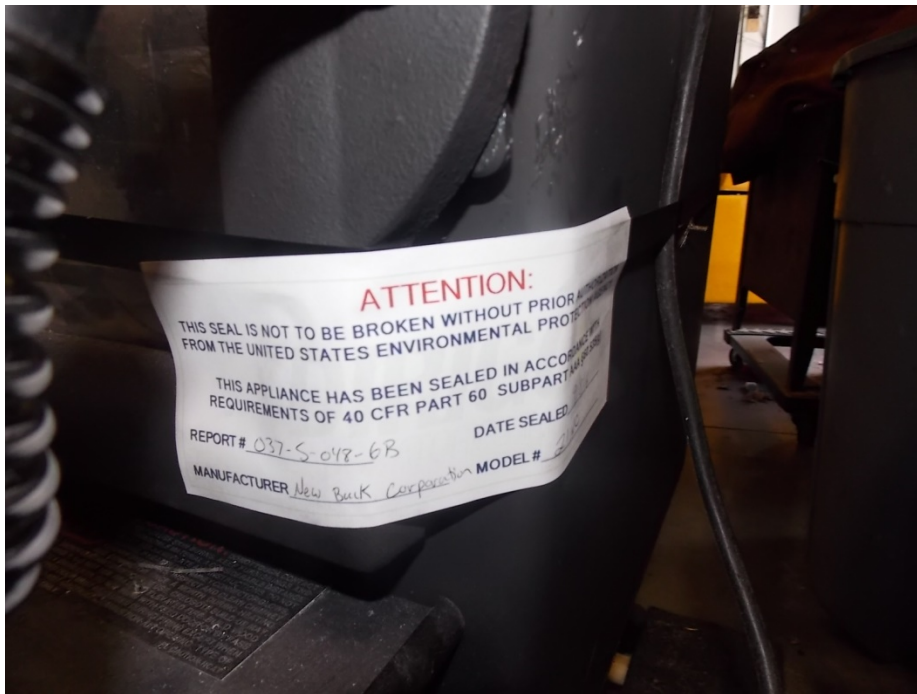
Appliance Sealing and Storage:

Following securing with metal strapping and the seal below, the appliance was placed into storage at client facilities located at: 200 Ethan Allen Dr., Spruce Pine, NC 28777.

Sealing Label

ATTENTION:	
THIS SEAL IS NOT TO BE BROKEN WITHOUT PRIOR AUTHORIZATION FROM THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY.	
THIS APPLIANCE HAS BEEN SEALED IN ACCORDANCE WITH REQUIREMENTS OF 40 CFR PART 60 SUBPART AAA §60.535(g)	
REPORT # _____	DATE SEALED _____
MANUFACTURER _____	MODEL # _____

Sealed Unit



Appendices:

Appendix A:

Sampling and Analytical Procedures

All Sampling and analytical procedures were performed by Gary Nelke and Ben Nelke. All procedures used were directly from EPA Method 28R, ASTM 2515-11 and ASTM E2780-10. No alternative procedures were used for this test series.

Appendix B:

Participants

The following personnel performed all testing:

- Gary Nelke CMfgE

Analysis and Report Writing

The following people were involved with analysis and report writing:

- Ben Nelke, Gary Nelke CMfgE, Doug Towne

Observers:

The following people were observers during testing:

- NA

Appendix C:

Appliance Updates

No updates to the appliance were made.

Appendix D:

Test Equipment Calibration Audit:

- Calibrations for the platform scale and bench scale were performed with Certified Class F weights
- Moisture meter calibration was performed with Delmhorst moisture meter calibrator
- Gas Analyzer calibration performed with certified EPA Protocol gases
- 47mm filters weighed to a constant weight with calibrated analytical balance

All equipment calibration data submitted in separate digital file along with this report.

Appendix E:

Accreditations:

CERTIFICATE OF ACCREDITATION

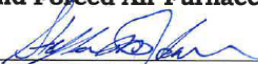
This certifies that:



Dirigo Laboratories, Inc.

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

October 21, 2015 - October 21, 2020
EFFECTIVE DATE


MEASUREMENT TECHNOLOGY GROUP
GROUP LEADER

Methods 28R, 28 WHH, 28 WHH-PIS,
All Methods listed in Sections 60.534 and 60.5476
METHODS

4
CERTIFICATE NUMBER



American Association for Laboratory Accreditation

Accredited Inspection Body

A2LA has accredited

DIRIGO LABORATORIES, INC.

Clackamas, OR

for technical competence as an

Inspection Body

This inspection body is accredited in accordance with the recognized International Standard ISO/IEC 17020:2012 *Conformity Assessment – Requirements for the operation of various types of bodies performing inspection*. This accreditation demonstrates technical competence for a defined scope and the operation of a quality management system.

Presented this 17th day of October 2014.



President & CEO
For the Accreditation Council
Certificate Number 3726.03
Valid to December 31, 2016

For the inspections to which this accreditation applies, please refer to the organization's Inspection Body Scope of Accreditation.



American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

DIRIGO LABORATORIES, INC.

Clakamas, OR

for technical competence in the field of

Mechanical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Presented this 17th day of October 2014.

President & CEO
For the Accreditation Council
Certificate Number 3726.01
Valid to December 31, 2016



For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Mechanical Scope of Accreditation.



American Association for Laboratory Accreditation

Accredited Product Certification Body

A2LA has accredited

DIRIGO LABORATORIES, INC.

Clackamas, OR

for technical competence as a

Product Certification Body

This product certification body is accredited in accordance with the recognized International Standard ISO/IEC 17065:2012 *Conformity Assessment – Requirements for Bodies Certifying Products, Processes and Services*. This accreditation demonstrates technical competence for a defined scope and the operation of a quality management system.

Presented this 17th day of October 2014.



President & CEO
For the Accreditation Council
Certificate Number 3726.02
Valid to December 31, 2016

For the product certification schemes to which this accreditation applies, please refer to the organization's Product Certification Scope of Accreditation