

**Confidential Business Information  
(Non - CBI)**

**Certification Test Report**

**MF Fire, Inc  
Model: Nova C**

**Wood-Fired Single Burn-Rate Room Heater  
(Freestanding, Catalytic)**

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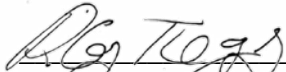
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MF Fire, Inc.  
Model: Nova C  
0552WS003E


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## 1. Introduction

MF Fire Inc, retained *OMNI* to perform U.S. Environmental Protection Agency (EPA) certification testing on the Nova C wood stove. The Nova C is a free-standing, single burn-rate catalytic room heater designed for residential use. Testing was performed by OMNI-Test Laboratories at OMNI's facility in Portland, Oregon. The altitude of the laboratory is thirty feet above sea level. The unit was received in good condition and logged in on 06/19/2023, then assigned and labeled with *OMNI* ID #2468. *OMNI* representative Riley Tiegs conducted the certification testing and completed all testing by 08/15/2023. 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.

The testing methodology used is composed of two distinct aspects:

- **Particulate Matter Emissions:**

The Nova C 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 ASTM E2515, and ASTM E2780. Particulate emissions were measured using sampling trains consisting of two Glass Fiber 47mm filters (front and back).

- **Stack Loss Efficiency:**

*CSA B415.1:22 "Performance testing of solid-biofuel-burning heating appliance"*. This document prescribes the processes and methods in securing data that may be computed to arrive at an efficiency based on flue-gas losses. It is also used to calculate the emissions of carbon monoxide. Results obtained for this report were calculated using version 2.4 of the spreadsheet provided by CSA for use in conjunction with the current edition of the CSA B415.1 standard. Example calculations for CSA B415.1:22 are not provided in this report since the approved software is controlled by password protection.

### Executive Summary

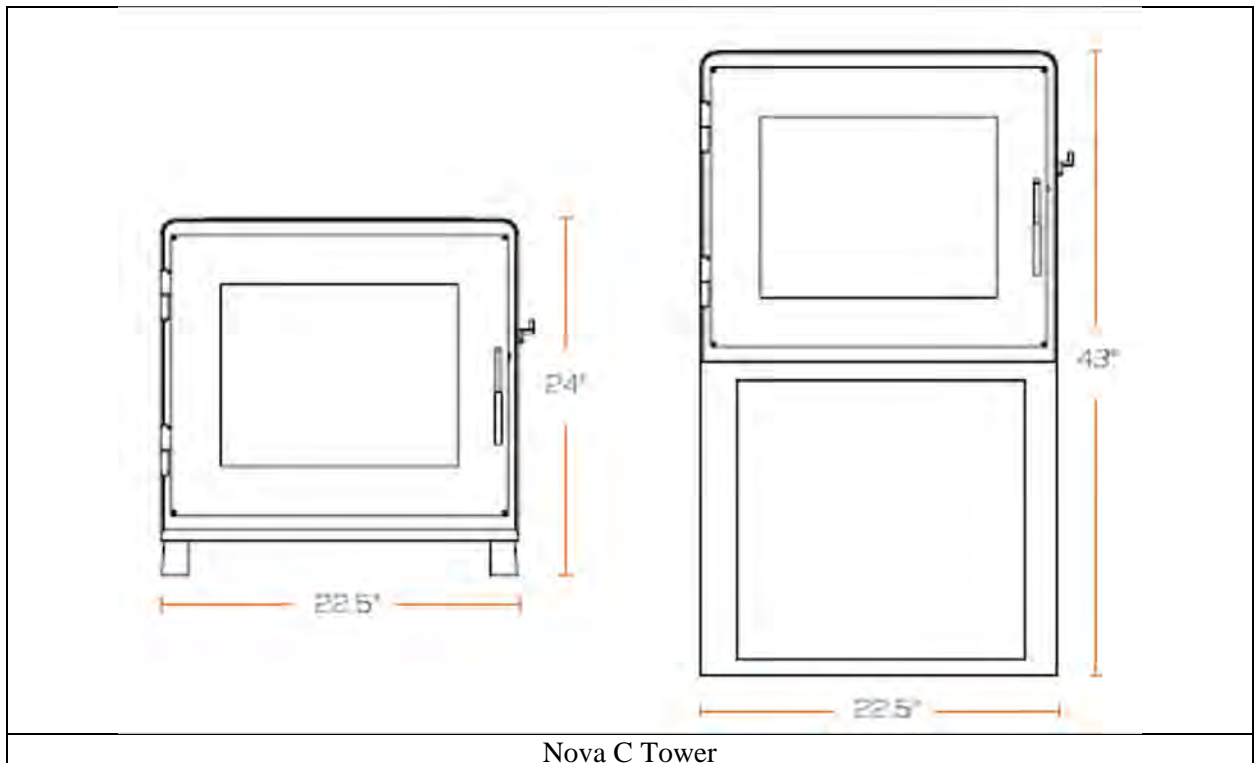
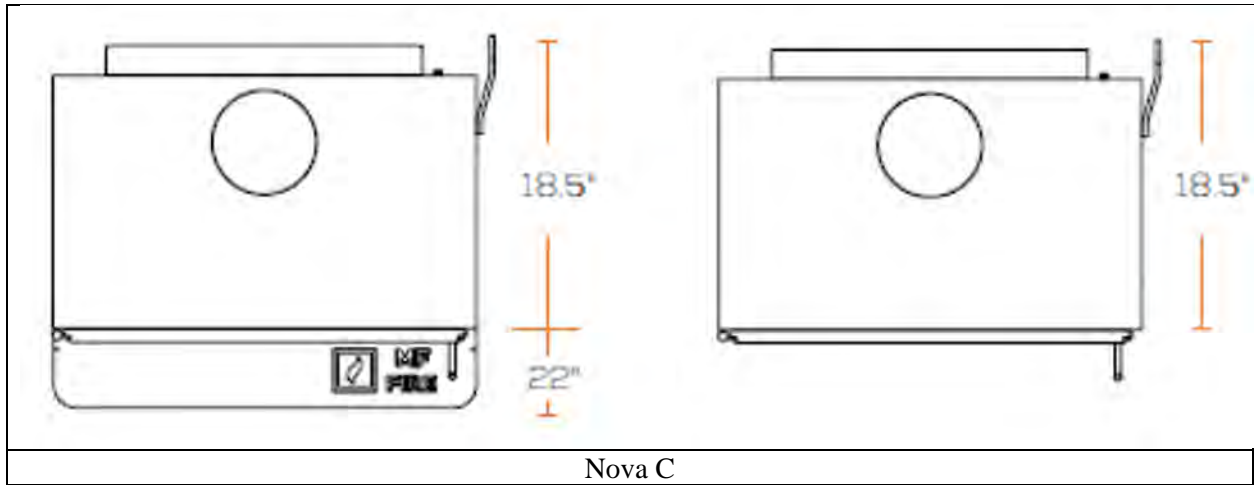
The MF Fire model Nova C is a single burn-rate appliance with fixed, non-adjustable air inlets. This testing regiment requires two valid test runs with burn-rates within 10% of their average values. Testing of the MF Fire model Nova C consisted of six test runs (Run 1 – Run 6) with two runs (Run 2 and Run 6) being used for the single burn-rate average emissions. Run 1 was an invalid test run due to the train precision being out of allowances provided by the standard. Run 3 was an invalid test run due to excessive filter temperatures. Run 4 was an invalid test run due to post-test leak check failure of the pitot tube and associated plumbing. Run 5 was an invalid test run due to proportionality issues between trains A and B.

The average emissions of the two valid tests (Run 2 and Run 5) included in the results indicate a particulate emission rate of 1.92 grams per hour. The burn-rates of runs 2 and 5 differed by 3.3 percent of their average.

The proportionality results for the two test runs used were acceptable. Quality check results for both runs are presented in Section 3 of this report. No sampling anomalies occurred, runs 2 and 6 were determined to be valid and appropriate.

### Appliance Description

The Nova C stove is a free-standing single-burn rate wood burning stove that uses natural draft for airflow and a catalyst for emission reduction. Primary air is vented from the back of the stove through two 1.65 x 0.98 in. rectangular openings. Primary air is then transferred through a U-shape square tube where it is heated and then forced downward into the firebox by the door. Secondary air is drawn from the back of the stove through a 5.44 in x 0.50 in. rectangular opening where it enters the interior of the baffle and emerges into the firebox through a matrix of holes on the bottom side of the baffle. The appliance is offered with a leg version (Nova C) and a pedestal version (Nova C Tower). Both models are identical, only the supporting structure (legs or pedestal) are different.



## General Information

**Type:** Wood-Fired Room Heater (Freestanding, Catalytic), Single Burn-Rate

**Materials of Construction:** The unit is constructed primarily of mild steel. The firebox is lined with firebrick over insulation board. The feed door has a 14.25 inches x 12.75 inches glass panel and 1" fiberglass rope gasket.

**Air Introduction System:** The Nova C stove is a free-standing single-burn rate wood burning stove that uses natural draft for airflow and a catalyst for emission reduction. Primary air is vented from the back of the stove through two 2.375 in. x 0.50 in. rectangular openings. Primary air is then transferred through a U-shape square tube where it is heated and then forced downward into the firebox by the door. Secondary air is drawn from the back of the stove through a 5-7/8 in. x 0.50 in. rectangular opening where it enters the interior of the baffle and emerges into the firebox through a matrix of holes on the bottom side of the baffle.

**Combustion Control Mechanisms:** None - single burn rate appliance with no controls

**Combustor:** MF Fire, Inc SKU N11, 2.5" x 13" x 2"

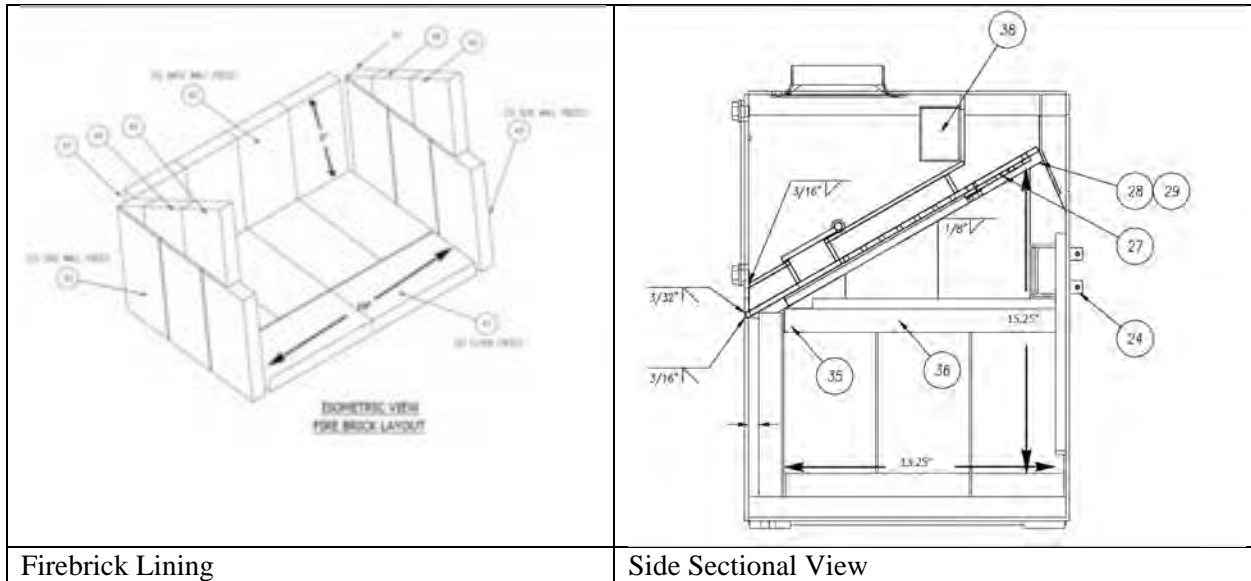
**Internal Baffles:** Air travels through a catalytic combustor located above the firebox. The baffle also has a bypass opening where exhaust travels when the bypass is open.

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

**Other Features:** None

### Firebox Volume and Calculations

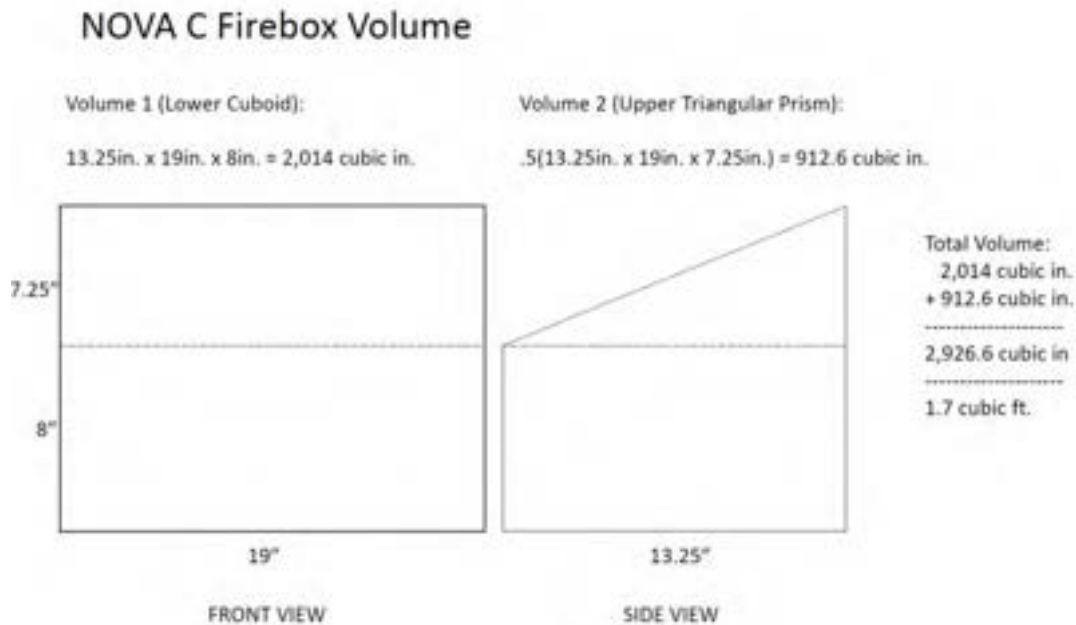
The firebox is constructed of mild steel and lined with firebricks. A steel frame with ceramic glass fuel loading door with an opening measuring 15.28" W x 12.76" H dominates the front side of the appliance.



The extents of the regions that define the total volume within the firebox are identified as being usable.

$$\text{Total firebox volume} = 1.7 \text{ ft}^3$$

$$\text{Usable Firebox Volume} = \text{Total Firebox Volume} - 0 = 1.7 \text{ ft}^3$$



## 2. Testing Preparation and Facility

### Conditioning

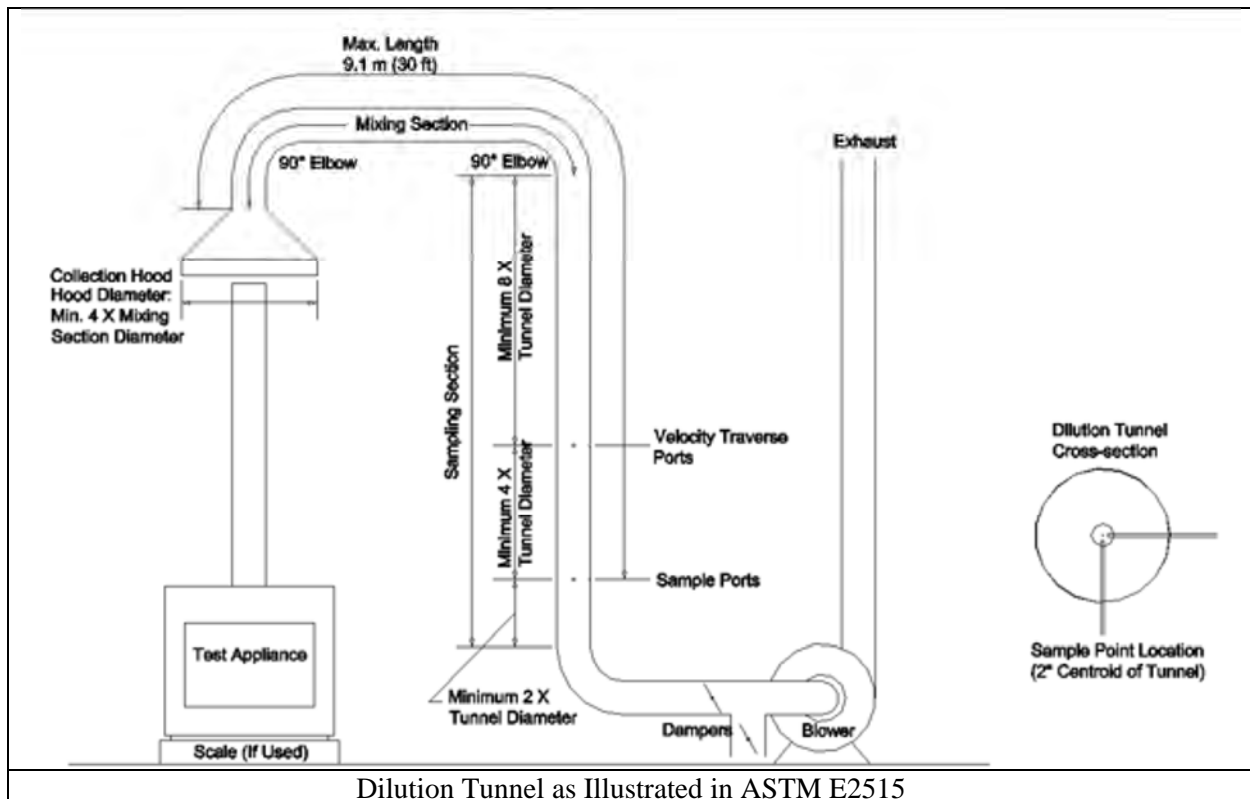
The required minimum 50 hours of conditioning was conducted by the manufacturer in advance of shipment of the appliance to OMNI. See Section 4 of this report for the conditioning data.

### Appliance Installation

In preparation for testing, the appliance was placed on a 1000 lb. capacity scale and fitted with a section of single wall connector pipe to a height approximately eight feet from the top surface of the scale and extended further upward to a height of approximately 15 feet with UL 103 solid-pack chimney. Both the chimney connector and chimney were a nominal six inch inside diameter. The base portion of the solid pack chimney was fitted with a 3/8-inch diameter hole for ready access of a flue gas probe and with a 3/16" diameter hole for ready access of a flue temperature probe. A 3/8" diameter hole was also procured at the base of the chimney connector within 1 foot of the appliance for the purpose of serving a draft probe. All joining sections of pipe and flue attachment were sealed with furnace cement. The appliance was then fitted with thermocouples for surface temperature measurement.

### Dilution Tunnel

OMNI's facility uses permanent and dedicated dilution tunnels that are designed and are maintained to meet the specifications of the dilution tunnel specifications prescribed in ASTM E2515. The dilution tunnel was cleaned on 7/10/23 immediately prior to the test series. Prior to testing, sample point and traverse point locations are verified to ensure their locations are within the prescribed specifications. Collection hood, tunnel diameter, and mixing section length are also verified to be within specifications.





### Sampling Systems

The sampling systems consisted of two independent systems, each managing two dry gas meters (a total of four dry gas meters). One of the systems was designated for sampling of Train A and Train B for the duration of test(s), and the other system was designated for sampling of the First Hour emissions and background ambient particulate. These systems were arranged identically to and in accordance with Section 6 of ASTM E2515 with the only exception that the pressure drop through an orifice on the exhaust end of each meter were monitored with a monometer to aid in identifying and responding to changes in the sample flow rates during operation.

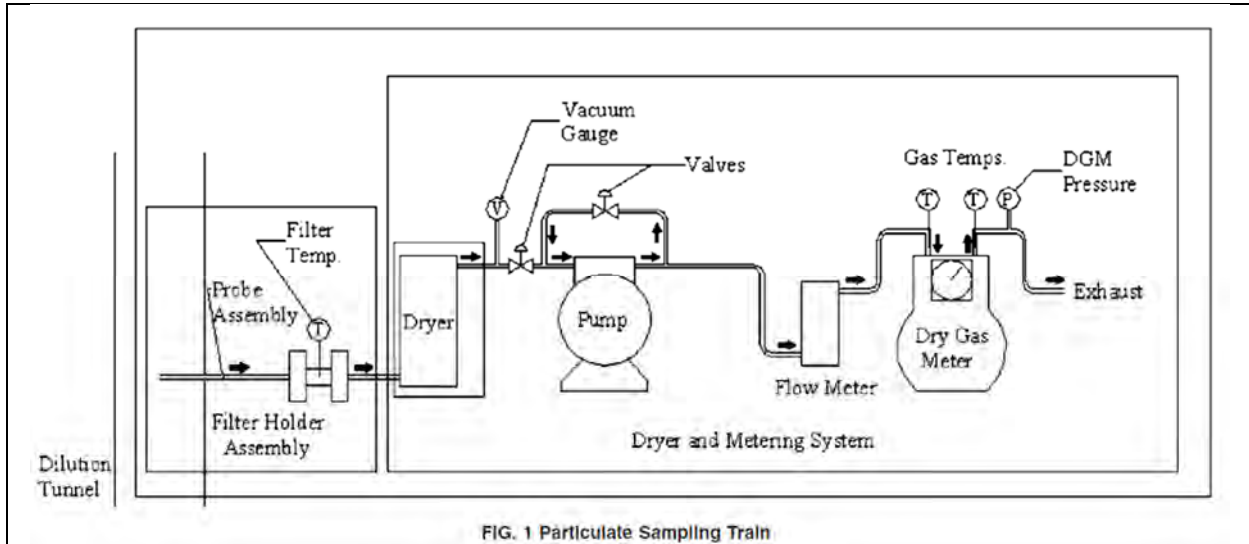
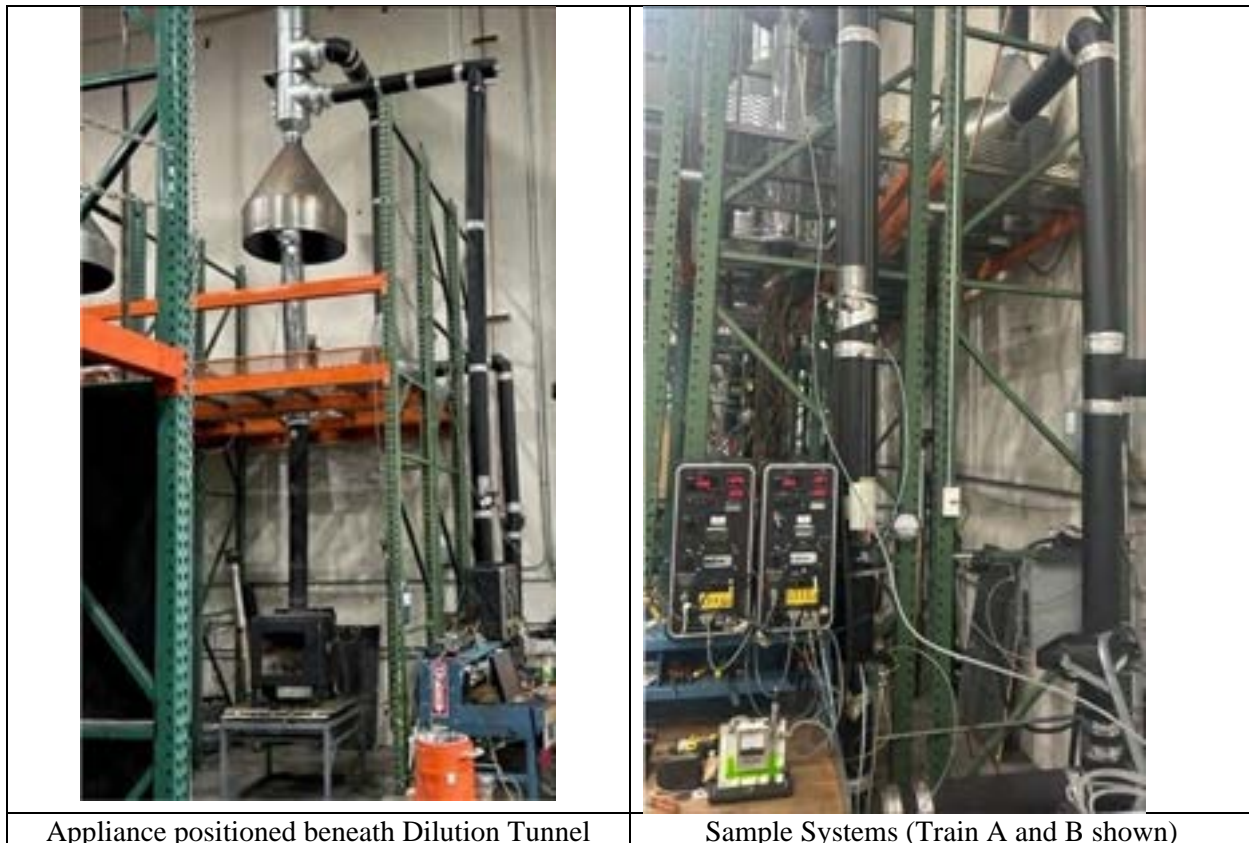


Figure from ASTM E2515 of typical sampling system (showing One gas meter)



**Manufacturer's Written Instructions  
(Provided by manufacturer)**

## Nova C Lab Instructions

- Open the bypass
- Open the front loading door
- Level the coal bed
- Place test load onto coal bed
- Close the front loading door
- Close the bypass



### 3. SAMPLING PROCEDURES AND TEST RESULTS

#### RUN NARRATIVES

**Run 1** – Test procedures prescribed within ASTM E2780, ASTM E2515 and CSA B415.1 were followed to produce a burn rate of 2.06 kg/h (no controls available on the appliance as this is a single burn-rate appliance). Sampling was conducted in accordance with ASTM E2515. Negative filter weights were found on train A (post first hour) which was caused by filter material transferring to the O-ring gasket. Transfer weight can be seen as a positive weight on the O-rings. Negative filter is added back into the calculation to offset transfer weight as being counted as emissions. The train precision was found to be unacceptable and so this test run was determined to be invalid and inappropriate for inclusion in the average.

#### Run 1 Sampling portion Start-up Procedures

- Bypass: Used to load fuel, then closed once the door was shut.
- Fuel Loading: Fuel Loading was completed by 35 seconds.
- Door: Fuel door was open to load fuel then closed at 40 seconds.
- Primary Air: n/a – Single Burn-Rate Appliance (fixed)
- Secondary Air: n/a – Single Burn-Rate Appliance (fixed)No user control for secondary air.

	
<b>Run 1 – Test Fuel</b>	<b>Run 1 – Loaded Stove</b>

**Run 2** – Test procedures prescribed within ASTM E2780, ASTM E2515 and CSA B415.1 were followed to produce a burn rate of 1.98 kg/h (no controls available on the appliance as this is a single burn-rate appliance). Sampling was conducted in accordance with ASTM E2515. No negative filter weights were found on either trains A or B nor did any other sampling anomalies occur. This test run was determined to be valid and appropriate for inclusion in the average emissions calculations.

**Run 2 Sampling portion Start-up Procedures**

- Bypass: Used to load fuel, then closed once door was shut.
- Fuel Loading: Fuel Loading was completed by 40 seconds.
- Door: Fuel door was open to load fuel then closed at 45 seconds.
- Primary Air: n/a – Single Burn-Rate Appliance (fixed)
- Secondary Air: n/a – Single Burn-Rate Appliance (fixed)No user control for secondary air.



**Run 2 – Test Fuel**



**Run 2 – Loaded Stove**

**Run 3** – Test procedures prescribed within ASTM E2780, ASTM E2515 and CSA B415.1 were followed to produce a burn rate of 1.91 kg/h (no controls available on the appliance as this is a single burn-rate appliance). Sampling was conducted in accordance with ASTM E2515. No negative filter weights were found. Filter temperatures were found to exceed the limitations set forth in ASTM E2780 and therefore the run was determined to be invalid and not appropriate for use.

### Run 3 Sampling portion Start-up Procedures

Bypass: Used to load fuel, then closed once door was shut.

Fuel Loading: Fuel Loading was completed by 25 seconds.

Door: Fuel door was open to load fuel then closed at 30 seconds.

Primary Air: n/a – Single Burn-Rate Appliance (fixed)

Secondary Air: n/a – Single Burn-Rate Appliance (fixed) No user control for secondary air.



**Run 3 – Test Fuel**



**Run 3 – Loaded Stove**

**Run 4** – Test procedures prescribed within ASTM E2780, ASTM E2515 and CSA B415.1 followed to produce a burn rate of 2.28 kg/h (no controls available on the appliance as this is a single burn-rate appliance). Sampling was conducted in accordance with ASTM E2515. No negative filter weights were found. The post-test leak check of the pitot tube and associated plumbing failed and therefore the run was determined to be invalid and not appropriate for use. Although the pitot tube did pass the pre-test leak check, investigation following the post-test failure revealed that a “quick-connect” fitting that had been unplugged and re-plugged prior to the test run and it was not fully and securely seated into its receiving socket causing intermittent leakage.

#### Run 4 Sampling portion Start-up Procedures

Bypass: Used to load fuel, then closed once door was shut.

Fuel Loading: Fuel Loading was completed by 30 seconds.

Door: Fuel door was open to load fuel then closed at 35 seconds.

Primary Air: n/a – Single Burn-Rate Appliance (fixed)

Secondary Air: n/a – Single Burn-Rate Appliance (fixed) No user control for secondary air.



**Run 4 – Test Fuel**



**Run 4 – Loaded Stove**

**Run 5** – Test procedures prescribed within ASTM E2780, ASTM E2515 and CSA B415.1 were followed to produce a burn rate of 2.11 kg/h (no controls available on the appliance as this is a single burn-rate appliance). Sampling was conducted in accordance with ASTM E2515. No negative filter weights were found. The proportionality between trains A and B were found to be more than the permitted magnitude permitted by ASTM E2780 and the run was determined to be invalid and not appropriate for use.

#### Run 5 Sampling portion Start-up Procedures

Bypass: Used to load fuel, then closed once door was shut.

Fuel Loading: Fuel Loading was completed by 30 seconds.

Door: Fuel door was open to load fuel then closed at 35 seconds.

Primary Air: n/a – Single Burn-Rate Appliance (fixed)

Secondary Air: n/a – Single Burn-Rate Appliance (fixed)No user control for secondary air.



**Run 5 – Test Fuel**



**Run 5 – Loaded Stove**

**Run 6** – Test procedures prescribed within ASTM E2780, ASTM E2515 and CSA B415.1 were followed to produce a burn rate of 1.72 kg/h (no controls available on the appliance as this is a single burn-rate appliance). Sampling was conducted in accordance with ASTM E2515. No negative filter weights were found, nor did any other sampling anomalies occur. This test run was determined to be valid and appropriate for inclusion in the average emissions calculations.

**Run 6 Sampling portion Start-up Procedures**



Bypass: Used to load fuel, then closed once door was shut

Fuel Loading: Fuel loading started once door was open and was completed at 60 seconds

Door: Fuel Door closed at 65 sec.

Primary Air: n/a – Single Burn-Rate Appliance (fixed)

Secondary Air: n/a – Single Burn-Rate Appliance (fixed)No user control for secondary air.

	
<p><b>Run 6 – Test Fuel</b></p>	<p><b>Run 6 – Coal bed at End of Test</b></p>



## Summary Tables

**Table 1 – Particulate Emissions**

<b>Run</b>	<b>Burn Rate</b> (kg/h dry)	<b>ASTM E2515 Emissions</b> <sup>1</sup> (Corrected) (g/h)	<b>ASTM E2515 Emissions</b> <sup>2</sup> (Uncorrected) (g/h)
1	2.06	2.85	3.16
2	1.98	1.93	*1.93
3	1.91	2.41	*2.41
4	2.28	5.31	*5.31
5	2.11	2.29	*2.29
6	1.72	1.88	*1.88
<b>AVG</b>	<b>1.85</b>	<b>1.90</b>	<b>1.90</b>
<b>Average is Single Burn-Rate Emission average of Runs 2 and 6</b>			

<sup>1</sup>Corrected refers to gravimetric analysis that takes negative filter weights as a negative value in cases where filter residue was transferred to (stuck to) O-ring gaskets to account for the mass transfer.

<sup>2</sup>Uncorrected refers to gravimetric analysis where negative filter weights are taken as zero, thus reporting a higher value by over-reporting of transferred filter material. The uncorrected values were added to this report in response to a request by the US EPA.

\* Indicates that no correction was made (there were no negative filter weights)

**Table 2 – Particulate Emissions (First Hour)**

<b>Run</b>	<b>ASTM E2515 Emissions</b> – First Hour <sup>1</sup> (Corrected) (g/h)	<b>ASTM E2515 Emissions</b> – First Hour <sup>2</sup> (Uncorrected) (g/h)
1	8.44	*8.44
2	4.40	*4.40
3	7.26	*7.26
4	10.82	*10.82
5	5.49	*5.49
6	6.16	*6.16

<sup>1</sup>Corrected refers to gravimetric analysis that takes negative filter weights as a negative value in cases where filter residue was transferred to (stuck to) O-ring gaskets to account for the mass transfer.

<sup>2</sup>Uncorrected refers to gravimetric analysis where negative filter weights are taken as zero, thus reporting a higher value by over-reporting of transferred filter material. The uncorrected values were added to this report in response to a request by the US EPA.

\* Indicates that no correction was made (there were no negative filter weights)

**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	27,836	68.3	73.8	3.06	41.33	1.42
2	28,140	71.8	77.6	2.04	28.99	0.96
3	23,522	62.3	67.3	2.87	35.44	1.13
4	32,182	71.2	76.9	2.56	36.10	1.37
5	30,375	72.0	77.8	4.07	58.01	2.06
6	23,654	69.5	75.1	2.33	32.10	0.92
<b>*AVG</b>	<b>25,897</b>	<b>70.65</b>	<b>76.35</b>	<b>2.19</b>	<b>30.55</b>	<b>0.94</b>
<b>*Averages of Runs 2 and 6</b>						

**Table 4 – Test Facility Conditions**

Run	Room Temperature (°F)		Barometric Pressure (Hg)		Air Velocity (ft/min)	
	Before	After	Before	After	Before	After
1	85	83	30.08	30.03	<50	<50
2	84	84	30.06	30.03	<50	<50
3	89	86	29.98	30.00	<50	<50
4	85	85	30.14	30.14	<50	<50
5	85	84	30.14	30.14	<50	<50
6	88	89	29.99	29.96	<50	<50

**Table 5 – Fuel Measurement and Crib Description Summary – PRETEST  
 Douglas Fir Dimensional Lumber**

Run	Pretest Fuel Weight (lbs.)	Pretest Moisture (Dry basis - %)	Coal Bed Weight (lbs.)
1	7.8	19.9	3.2
2	7.5	21.9	2.5
3	11.7	23.3	2.8
4	11.7	22.8	2.7
5	10.6	20.2	2.6
6	8.4	22.5	2.9

**Table 6 – Fuel Measurement and Crib Description Summary – TEST  
 Douglas Fir Dimensional Lumber**

Run	Test Fuel Wet Basis (lbs.)	Firebox Volume (ft <sup>3</sup> )	Loading Density Wet Basis (lbs./ft <sup>3</sup> )	Test Fuel Dry Basis (lbs.)	Length (in)	2x4s Used	4x4s Used
1	12.7	1.70	33.73	27.96	14	3	2
2	12.2	1.70	32.20	26.49	14	3	2
3	12.8	1.70	34.65	28.43	14	3	2
4	12.4	1.70	32.51	26.84	14	3	2
5	12.6	1.70	34.35	28.14	14	3	2
6	11.8	1.70	32.20	26.32	14	3	2

**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	141	21.87	227.5	128.44
2	140	22.83	238.5	125.82
3	151	23.06	238.1	131.66
4	123	22.94	239.8	127.28
5	134	18.72	200.0	114.50
6	155	18.77	196.0	124.08

**Table 8 – Appliance Average Temperature Data**

Run	Beginning Surface Temperature Average, °F	Ending Surface Temperature Average, °F	Surface Delta T <sup>b</sup>
1	456	385	52
2	444	404	40
3	497	408	66
4	444	417	27
5	443	412	31
6	431	392	39

b. Represents the difference between beginning and ending average surface temperatures.

**Table 9 – Pretest Configuration**

<b>Run</b>	<b>Combustion Air</b>	<b>Fuel Added</b>	<b>Fuel Added</b>	<b>Time (min)</b>
1	Fixed (non-Adjustable)	8.0	N/A	59
2	Fixed (non-Adjustable)	9.4	N/A	89
3	Fixed (non-Adjustable)	N/A	N/A	N/A
4	Fixed (non-Adjustable)	N/A	N/A	N/A
5	Fixed (non-Adjustable)	4.9	N/A	65
6	Fixed (non-Adjustable)	8.4	N/A	139

## 4. TEST DATA BY RUN

## Conditioning Data

MF Fire  
 3031 Washington Boulevard, Suite G  
 Baltimore, MD 21230  
 Nova C



All conditioning was conducted using untreated wood with moisture content between 19%-25%.

Time (Hour)	Weight (lb)	Flue Temp (F)	Cat temp (F)	Date	Technician
0	13.3	344	730	5/1/2023	R. Fisher
1	4.7	366	966	5/1/2023	
2	1.5	320	817	5/1/2023	
3	0.3	293	727	5/1/2023	
4	13.3	405	684	5/1/2023	R. Fisher
5	3.8	484	933	5/1/2023	
6	1.2	370	779	5/1/2023	
7	0.1	350	745	5/1/2023	
8	12.8	469	795	5/3/2023	R. Fisher
9	3.6	950	488	5/3/2023	
10	1	401	774	5/3/2023	
11	0.2	371	716	5/3/2023	
12	12.3	231	668	5/3/2023	R. Fisher
13	4.5	490	1020	5/3/2023	
14	2.1	366	706	5/3/2023	
15	0.2	361	371	5/3/2023	
16	12.3	493	794	5/4/2023	R. Fisher
17	3.5	502	1034	5/4/2023	
18	0.9	391	757	5/4/2023	
19	0.4	378	726	5/4/2023	
20	12.5	492	844	5/5/2023	R. Fisher
21	3.7	534	1037	5/5/2023	
22	0.7	422	775	5/5/2023	
23	0.1	412	747	5/5/2023	
24	13.1	296	863	5/8/2023	R. Fisher
25	4	305	945	5/8/2023	
26	1.1	249	775	5/8/2023	
27	0.2	232	232709	5/8/2023	
28	12.8	378	827	5/9/2023	R. Fisher
29	4.4	395	937	5/9/2023	
30	1.4	329	764	5/9/2023	
31	0.3	307	703	5/9/2023	
32	12.9	391	786	5/10/2023	R. Fisher
33	3.9	444	1049	5/10/2023	
34	1.3	327	711	5/10/2023	
35	0.4	316	696	5/10/2023	
36	12.9	303	832	5/11/2023	R. Fisher
37	3.2	339	1082	5/11/2023	
38	0.4	357	779	5/11/2023	

39	12.6	322	759	5/11/2023	R. Fisher
40	3.8	1089	385	5/11/2023	
41	0.4	252	797	5/11/2023	
42	12.5	487	812	5/16/2023	R. Fisher
43	2.8	518	989	5/16/2023	
44	0.4	407	737	5/16/2023	
45	12.6	485	771	5/17/2023	R. Fisher
46	2.6	556	1142	5/17/2023	
47	0.1	425	769	5/17/2023	
48	12.3	368	770	5/18/2023	R. Fisher
49	4.1	403	969	5/18/2023	
50	0.7	336	789	5/18/2023	



## Run 1 Test Data

## Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire  
 Model: Nova C  
 Project No.: 0552WS003E  
 Tracking No.: 2468  
 Run: 1  
 Test Date: 07/11/23

Technician Signature: \_\_\_\_\_

Burn Rate	<b>2.06 kg/hr dry</b>
Average Tunnel Temperature	128 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	21.87 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	13647.6 dscf/hour
Average Delta p	0.104 inches H2O
Total Time of Test	141 minutes

	AMBIENT	SAMPLE TRAIN 1	SAMPLE TRAIN 2	FIRST HOUR FILTER (TRAIN 1)		
Total Sample Volume - Vm	22.024 cubic feet	22.785 cubic feet	22.431 cubic feet	9.605 cubic feet		
Average Gas Meter Temperature	83 degrees Fahrenheit	92 degrees Fahrenheit	93 degrees Fahrenheit	88 degrees Fahrenheit		
Total Sample Volume (Standard Conditions) - Vms	21.746 dscf	22.115 dscf	21.886 dscf	9.375 dscf		
Total Particulates - m <sub>p</sub>	0.1 mg	6 mg	3.4 mg	0 mg		
Particulate Concentration (dry-standard) - C <sub>p</sub> /C <sub>s</sub>	0.000005 grams/dscf	0.00027 grams/dscf	0.00016 grams/dscf	0.00000 grams/dscf		
Total Particulate Emissions - E <sub>T</sub>	0.15 grams	8.55 grams	4.83 grams	0.00 grams		
Particulate Emission Rate	0.06 grams/hour	3.64 grams/hour	2.06 grams/hour	0.00 grams/hour		
Emissions Factor		1.77 g/kg	1.00 g/kg	0.00 g/kg		
Difference from Average Total Particulate Emissions		1.86 grams	1.86 grams			
<b>Final Average Results</b>		<b>Quality Checks</b>				
		Requirement	Measured / Observed			
			First Hour	Train 1	Train 2	Complies?
<b>Complete Test Run</b>						
Total Particulate Emissions - E <sub>T</sub>	6.69 grams	Filter Temps, °F	86	86	88	OK
Particulate Emission Rate	<b>2.85 grams/hour</b>	Filter Face Velocity, fpm	8.73	8.78	8.78	OK
Emissions Factor	1.38 grams/kg	Dryer Exit Temp, °F	60	60	49	OK
		Leakage Rate, cfm < 4% of avg sample rate or < 0.01 cfm, lesser of the two	0.000	0.001	0.001	OK
		Neg. Probe Weight	0	0	0	OK
<b>First Hour Emissions</b>						
Total Particulate Emissions - E <sub>T</sub>	0.00 grams	< 90 for < 10% of θ	0.00%	0.00%	0.00%	OK
Particulate Emission Rate	0.00 grams/hour	> 110 for < 10% of θ	0.00%	0.00%	0.00%	OK
Emissions Factor	0.00 grams/kg	# Readings < 80%	0	0	0	OK
		# Readings > 120%	0	0	0	OK
7.5% of Average Total Particulate Emissions	0.50 grams	Ambient Temp, °F		81		OK
		(min / max)		85		OK
		Train Precision		27.8%		Unacceptable
		One of A or B must conform		0.77		
		Stove Surface ΔT		52		OK
		Room Air Velocity		16		OK

## Wood Heater Test Fuel Data - ASTM E2780

Manufacturer : MF Fire  
 Model : Nova C  
 Tracking No. : 2468  
 Project No. : 0552WS003E  
 Test Date : 7/11/2023  
 Run No. : 1

Moisture Meter Cal	
Cal Block	Measured
12.0	12.0
22.0	22.0

Firebox Volume : 1.70 ft<sup>3</sup>  
 % 2 x 4 Required : 35 - 65 %  
 Ideal Fuel Weight : 11.9 lb.  
 Minimum Fuel Weight : 10.71 lb.  
 Maximum Fuel Weight : 13.09 lb.

Fuel Piece Data										Wet Weights, lb		Dry Weights, lb	
PC #	Weight, lb	Size	Length, In	Moisture Readings, Dry Basis %			Average MC, % db	Dry Weight, lb.	Volume, ft <sup>3</sup>	4 x 4	2 x 4	4 x 4	2 x 4
1	1.20	2x4	14.00	19.6	21.0	19.7	20.1	1.00	0.0425		1.2		1.00
2	1.30	2x4	14.00	19.9	20.6	19.8	20.1	1.08	0.0425		1.3		1.08
3	1.40	2x4	14.00	20.6	22.2	19.9	20.9	1.16	0.0425		1.4		1.16
4	3.80	4x4	14.00	22.3	19.4	19.2	20.3	3.16	0.0992	3.8		3.16	
5	3.30	4x4	14.00	22.0	19.9	22.0	21.3	2.72	0.0992	3.3		2.72	
6													
7													
8													
9													

Spacer Data															
Moisture Readings, Dry Basis % (One reading per spacer)										Avg : 10.4					
10.4	10.6	9.4	8.5												
10.5	8.4	12.0	11.4												
12.4	7.5	12.2	9.7												
11.4	9.2	12.0	11.2												

Assembled Crib Fuel Load with Spacers Attached													
PC #	Weight, lb with Spacers	Size	4 x 4s	2 x 4s									
					1	1.70	2x4		1.7000				
2	1.70	2x4		1.7000									
3	1.80	2x4		1.8000									
4	4.00	4x4	4.00										
5	3.50	4x4	3.50										
6													
7													
8													
9													
					Combined Mass of 4 x 4s	7.5	lb						
					Combined Mass of 2 x 4s	5.2	lb						
					Total Wet Mass of Fuel Load	12.7	lb						

Fuel Load Properties										
Type	Number of Pieces	Wet Weight, lb.	Dry Weight, lb.	Fuel Loading Density, lb/ft <sup>3</sup>		Dry Fuel Density, lb/ft <sup>3</sup>	Wet Fuel Density, lb/ft <sup>3</sup>	Moisture, %		
				Wet Basis	Dry Basis			Dry Basis	Wet Basis	
2 x 4	3	3.9	3.24	7.47	6.27	27.96	33.73	19.16	16.08	
4 x 4	2	7.1	5.88							
Spacers	16	1.7	1.54							
Totals		12.7	10.66							

Compliance Checks						
	Fuel Load, Wet Lb.	Load Density, lb/ft <sup>3</sup> of FB vol	Fuel Density, lb/ft <sup>3</sup>	% of Fuel load mass which is 2x4	Fuel Load Peices Mositure, % db	
Measured	12.7	7.47	27.96	41	20.5	
Required	10.7 - 13.1	6.3 - 7.7	25 - 36	35 - 65	19 - 25	
Complies ?	Yes	Yes	Yes	Yes	Yes	

## Wood Heater Preburn Data - ASTM E2780

**Run:** 1

Technician Signature \_\_\_\_\_

Manufacturer: MF Fire  
 Model: Nova C  
 Tracking No.: 2468  
 Project No.: 0552WS003E  
 Test Date: 7/11/23

Beginning Clock Time: \_\_\_\_\_

Coal Bed	<b>2.5</b>	<b>3.2</b>
Range (lb):	(min)	(max)

Preburn Fuel Data					
3 pieces @		10 inches			
4 pieces @		14 inches			
_____ pieces @		_____ inches			
Fuel Moisture Readings (% DB):					
	20	20.3			
	19	20.6			
	20.1	19.7			
	19.5	19.1			
	23	21.6			
Avg Preburn Moisture (% DB):					
<b>20.29</b>					

Elapsed Time (min)	Scale (lb)	Stack Draft (in H <sub>2</sub> O)	Temperatures (°F)								
			FB Top	FB Bottom	FB Back	FB Left	FB Right	Cat Exit	Avg. FB	Stack	Ambient
0	11.4	-0.062	468	170	373	357	304	3218	334.3	382	82
1	10.1	-0.062	462	172	373	357	304	3218	333.6	367	82
2	10	-0.065	454	174	372	357	304	3218	332.2	372	82
3	9.9	-0.066	459	177	368	357	304	3218	332.9	382	82
4	9.8	-0.066	461	179	365	356	304	3218	332.8	387	82
5	9.8	-0.066	474	181	360	356	303	3218	334.9	391	82
6	9.5	-0.067	485	183	357	355	302	3218	336.4	396	82
7	9.4	-0.068	499	184	353	355	302	3218	338.4	400	82
8	9.3	-0.067	508	186	349	354	301	3218	339.5	402	82
9	9.2	-0.067	517	188	346	353	300	3218	340.8	403	82
10	9	-0.069	542	189	343	353	299	3218	345.1	409	82
11	8.8	-0.07	566	191	340	352	299	3218	349.8	417	82
12	8.7	-0.07	591	193	338	352	298	3218	354.3	424	83
13	8.5	-0.071	608	194	336	352	298	3218	357.8	429	83
14	8.3	-0.071	620	196	335	351	298	3218	360.1	432	83
15	8.2	-0.07	635	197	334	352	298	3218	363.2	433	83
16	8	-0.07	644	198	333	351	299	3218	365.2	436	83
17	7.8	-0.071	655	200	333	352	300	3218	368.2	439	83
18	7.6	-0.071	663	202	333	352	302	3218	370.3	439	83
19	7.6	-0.071	667	203	334	353	303	3218	371.9	440	84
20	7.3	-0.07	671	205	334	355	305	3218	373.9	441	84
21	7.1	-0.071	675	206	335	356	306	3218	375.7	442	84
22	6.9	-0.07	680	208	336	358	308	3218	378.1	443	85
23	6.8	-0.07	685	209	337	360	310	3218	380.2	444	85
24	6.6	-0.071	690	211	339	362	313	3218	382.9	447	85
25	6.4	-0.071	697	213	340	365	315	3218	385.8	449	85
26	6.3	-0.071	708	214	342	367	318	3218	389.6	451	85
27	6.1	-0.071	714	216	344	370	320	3218	392.8	452	85
28	5.9	-0.072	721	217	347	373	323	3218	396.2	454	85
29	5.7	-0.071	731	219	350	376	326	3218	400.4	456	85
30	5.5	-0.072	736	221	352	379	329	3218	403.5	458	86
31	5.4	-0.071	743	222	355	383	333	3218	407.2	459	86
32	5.2	-0.072	753	224	358	386	336	3218	411.4	461	86
33	5.1	-0.072	760	226	360	389	339	3218	415	461	86
34	4.9	-0.07	769	227	363	393	342	3218	418.8	462	86
35	4.8	-0.071	770	229	366	396	345	3218	421.2	462	86
36	4.6	-0.071	772	230	369	399	349	3218	423.7	463	86
37	4.5	-0.072	775	232	372	403	352	3218	426.6	464	87
38	4.3	-0.072	777	233	376	406	355	3218	429.4	464	87
39	4.2	-0.071	777	235	379	410	358	3218	431.7	464	87
40	4.1	-0.07	771	236	383	412	361	3218	432.6	462	87
41	4	-0.07	766	237	386	416	364	3218	433.8	461	87
42	3.8	-0.071	762	239	391	419	367	3218	435.4	460	87

## Wood Heater Preburn Data - ASTM E2780

**Run:** 1

Technician Signature \_\_\_\_\_

Manufacturer: MF Fire  
 Model: Nova C  
 Tracking No.: 2468  
 Project No.: 0552WS003E  
 Test Date: 7/11/23

Beginning Clock Time: \_\_\_\_\_

Preburn Fuel Data					
	3 pieces @	10 inches			
	4 pieces @	14 inches			
	_____ pieces @	_____ inches			
Fuel Moisture Readings (% DB):					
	20	20.3			
	19	20.6			
	20.1	19.7			
	19.5	19.1			
	23	21.6			
Avg Preburn Moisture (% DB): <b>20.29</b>					

Coal Bed	<b>2.5</b>	<b>3.2</b>
Range (lb):	(min)	(max)

Elapsed Time (min)	Scale (lb)	Stack Draft (in H <sub>2</sub> O)	Temperatures (°F)								
			FB Top	FB Bottom	FB Back	FB Left	FB Right	Cat Exit	Avg. FB	Stack	Ambient
43	3.7	-0.07	752	241	395	422	369	3218	435.8	457	87
44	3.6	-0.07	746	242	399	425	372	3218	436.6	454	88
45	3.5	-0.071	736	244	403	427	374	3218	436.6	453	83
46	3.4	-0.069	733	245	406	429	376	3218	437.9	449	84
47	3.3	-0.069	723	247	410	432	378	3218	437.8	447	82
48	3.2	-0.069	706	248	414	435	380	3218	436.7	444	82
49	3.1	-0.068	708	250	418	436	382	3218	438.8	442	83
50	3	-0.068	699	252	422	438	384	3218	439	439	82
51	3	-0.067	689	254	426	440	385	3218	438.8	437	81
52	2.9	-0.067	682	255	431	441	387	3218	439.3	433	83
53	2.8	-0.066	674	256	435	443	387	3218	438.9	431	83
54	2.8	-0.065	659	258	439	444	389	3218	437.7	426	82
55	2.7	-0.065	649	259	443	444	390	3218	437.1	421	82
56	2.6	-0.065	633	261	447	445	391	3218	435.5	418	82
57	2.6	-0.064	621	262	451	445	391	3218	434.2	414	80
58	2.5	-0.064	612	263	454	445	392	3218	433.2	411	84
59	2.5	-0.064	599	265	456	445	392	3218	431.5	407	83
60	8	-0.068	583	267	460	445	392	3218	429.1	440	83
61	10.5	-0.07	583	268	463	444	392	3218	430.1	431	82
62	10.4	-0.07	592	270	464	444	392	3218	432.3	431	82
63	10.2	-0.072	608	271	463	442	392	3218	435.2	438	83
64	10	-0.072	625	272	460	441	393	3218	438.4	446	82
65	9.8	-0.072	642	274	457	440	393	3218	441.2	451	81
66	9.6	-0.073	660	275	455	440	393	3218	444.5	455	81
67	9.4	-0.074	678	276	452	439	394	3218	447.7	460	82
68	9.2	-0.074	692	278	450	438	394	3218	450.1	464	82
69	9	-0.073	711	278	448	438	394	3218	453.7	467	82
70	8.8	-0.074	719	279	446	437	395	3218	455.4	470	84
71	8.6	-0.074	728	280	445	437	395	3218	457.2	471	81
72	8.5	-0.074	736	281	445	438	397	3218	459.3	473	83
73	8.2	-0.074	749	282	444	438	398	3218	462.2	477	83
74	8.1	-0.075	755	283	444	439	399	3218	464.1	478	83
75	7.8	-0.074	763	284	444	440	401	3218	466.5	479	84
76	7.6	-0.075	766	285	445	442	402	3218	467.8	479	83
77	7.5	-0.074	771	286	446	443	403	3218	469.7	480	82
78	7.3	-0.075	770	287	446	444	405	3218	470.4	480	84
79	7.1	-0.074	771	287	447	445	406	3218	471.1	480	85
80	6.9	-0.074	774	288	447	447	408	3218	472.7	480	82
81	6.8	-0.073	778	288	448	448	409	3218	474.4	481	84
82	6.6	-0.073	782	289	450	451	411	3218	476.5	482	82
83	6.4	-0.074	782	290	451	452	412	3218	477.4	482	80
84	6.2	-0.073	786	290	452	454	413	3218	479.2	482	84
85	6.1	-0.073	795	291	453	456	415	3218	482	482	83

## Wood Heater Preburn Data - ASTM E2780

**Run:** 1

Technician Signature \_\_\_\_\_

Manufacturer: MF Fire  
 Model: Nova C  
 Tracking No.: 2468  
 Project No.: 0552WS003E  
 Test Date: 7/11/23

Beginning Clock Time: \_\_\_\_\_

Preburn Fuel Data					
	3 pieces @	10 inches			
	4 pieces @	14 inches			
	_____ pieces @	_____ inches			
Fuel Moisture Readings (% DB):					
	20	20.3			
	19	20.6			
	20.1	19.7			
	19.5	19.1			
	23	21.6			
Avg Preburn Moisture (% DB): <b>20.29</b>					

Coal Bed	<b>2.5</b>	<b>3.2</b>
Range (lb):	(min)	(max)

Elapsed Time (min)	Scale (lb)	Stack Draft (in H <sub>2</sub> O)	Temperatures (°F)								
			FB Top	FB Bottom	FB Back	FB Left	FB Right	Cat Exit	Avg. FB	Stack	Ambient
86	5.9	-0.073	798	291	455	457	416	3218	483.2	484	83
87	5.8	-0.074	803	292	456	459	418	3218	485.3	485	83
88	5.6	-0.073	807	292	457	461	419	3218	487.3	487	83
89	5.4	-0.074	810	293	459	463	420	3218	488.9	487	84
90	5.2	-0.074	815	294	461	465	422	3218	491.3	488	84
91	5.1	-0.074	818	294	463	467	423	3218	492.7	488	83
92	4.9	-0.073	825	294	464	468	425	3218	495.4	487	84
93	4.7	-0.073	827	295	466	471	426	3218	497.2	487	82
94	4.6	-0.073	828	295	468	472	427	3218	497.9	487	85
95	4.5	-0.073	832	296	470	474	428	3218	500.1	485	85
96	4.3	-0.073	830	297	471	476	430	3218	500.8	484	83
97	4.2	-0.072	835	296	473	478	432	3218	502.8	482	84
98	4.1	-0.071	830	297	475	479	432	3218	502.7	478	83
99	4	-0.072	821	297	476	482	433	3218	501.8	475	82
100	4	-0.071	812	297	478	483	434	3218	500.8	471	84
101	3.9	-0.07	800	297	479	485	435	3218	499.2	467	82
102	3.8	-0.07	784	297	481	486	436	3218	496.7	463	83
103	3.7	-0.069	757	297	483	486	436	3218	491.7	457	86
104	3.7	-0.069	747	297	484	488	436	3218	490.5	453	84
105	3.6	-0.068	728	298	485	488	436	3218	487.2	449	85
106	3.5	-0.068	712	299	487	488	436	3218	484.4	445	82
107	3.5	-0.067	695	298	488	488	436	3218	480.9	440	86
108	3.5	-0.068	679	300	489	487	435	3218	478.1	436	82
109	3.4	-0.067	666	300	489	487	435	3218	475.6	432	85
110	3.4	-0.067	652	301	489	486	435	3218	472.5	428	86
111	3.3	-0.066	643	301	489	485	433	3218	470.2	424	86
112	3.3	-0.066	631	303	489	483	433	3218	467.8	421	84
113	3.2	-0.065	622	304	489	483	432	3218	465.9	418	84
114	3.2	-0.064	616	303	488	481	431	3218	463.8	415	85
115	3.2	-0.065	604	304	487	479	430	3218	460.7	413	83

Run: 1

Manufacturer: MF Fire
Model: Nova C
Tracking No.: 2483
Project No.: 05245000E
Test Date: 05/24/2017
Beginning Clock Time: 13:38

Total Sampling Time: 141 min
Recording Interval: 6 min
Total Volume: 22.024 cubic feet
Background Sample Volume: 22.024 cubic feet

PM Control Modules: 335,338
Dilution Tunnel MM(dry): 29.00 lbb-mole
Dilution Tunnel MM(wet): 29.73 lbb-mole
Dilution Tunnel MM(wet): 27.73 lbb-mole
Dilution Tunnel MM(wet): 27.73 lbb-mole
Tunnel Area: 0.14835 ft2
Plot Tube Cp: 0.59

Avg. Tunnel Velocity: 21.87 ft/sec
Initial Tunnel Flow: 224.3 scfm
Avg. Tunnel Velocity: 22.73 scfm
Avg. Tunnel Velocity: 22.73 scfm
Post-Test Leak Check (1): 0.001 cfm @ 6 in. Hg
Post-Test Leak Check (2): 0.001 cfm @ 10 in. Hg
Post-Test Leak Check (3): 0.001 cfm @ 11 in. Hg
Dry Basis %: 19.16

Technician Signature:

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Meter Box Y Factor: 1.007 (1) 1.015 (2) 1.012 (Amb)
Room Air Velocity: 16

Biometric Pressure: Begin Middle End Average
30.08 30.03 30.03 30.05

OMNI Equipment Numbers:

Wood Heater Test Data

Table with columns: P.L1, P.L2, P.L3, P.L4, P.L5, P.L6, P.L7, P.L8, Center. Rows: Initial dp, Temp, Vavg, Vseal, Fp.

Velocity Traverse Data
P.L1 P.L2 P.L3 P.L4 P.L5 P.L6 P.L7 P.L8 Center
Initial dp 0.096 0.100 0.092 0.092 0.098 0.098 0.100 0.102 H2O
Temp: 133 133 133 133 133 131 131 131 F
Vavg 21.68 ft/sec Vseal 22.34 ft/sec Fp 0.971

Main data table with columns: Elapsed Time (min), Gas Meter 1 (ft3), Gas Meter 2 (ft3), Particulate Sampling Data (Orifice dH1, Orifice dH2, Meter 1 Vacuum, Meter 2 Vacuum, Meter 1 Temp, Meter 2 Temp, Orifice dH1, Orifice dH2, Meter 1 Vacuum, Meter 2 Vacuum, Dilution Tunnel Center dp, Pro. Rate Pro. Rate 2, Fuel Weight Scale Reading, Weight Change, Fibrox Bottom, Fibrox Top, Fibrox Left, Fibrox Right, Avg. Stove Surface Temperature, Stack, Filter 1, Filter 2, Driver Exit 1, Driver Exit 2, Ambient, CO2 (%), CO (%), Draift (H2O), Draift (%).









# Wood Heater Test Data

**Run:** 1  
 Manufacturer: MF Fire  
 Model: Nova C  
 Tracking No.: 2483  
 Project No.: 052WS02E  
 Beginning Clock Time: 13:38  
 Total Sampling Time: 141 min  
 Recording Interval: 6 min  
 Turn Down Time: 0 min  
 Background Sample Volume: 22,024 cubic feet

PM Control Modules: 335,338  
 Dilution Tunnel MM(dry): 29.00 lbb-mole  
 Dilution Tunnel MM(wet): 28.78 lbb-mole  
 Dilution Tunnel SDC: 2.00  
 Dilution Tunnel SDC: 3.00  
 Tunnel Area: 0.18335 ft<sup>2</sup>  
 Pilot Tube Cp: 0.59  
 Average Test Piece Fuel Moisture: 19.16 Dry Basis %

Avg. Tunnel Velocity: 21.87 ft/sec.  
 Initial Tunnel Flow: 224.3 scfm  
 Average Chamber Flow: 227.83 scfm  
 Post-Test Leak Check (1): 0.001 cfm @ 6 in. Hg  
 Post-Test Leak Check (2): 0.001 cfm @ 11 in. Hg

Technician Signature: \_\_\_\_\_

Meter Box Y Factor: 1.007 (1) 1.015 (2) 1.012 (Amb)  
 Barometric Pressure: Begin 30.08 Middle 30.03 End 30.05 Average 30.05  
 Room Air Velocity: 16

Velocity Traverse Data								
Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dp	0.096	0.100	0.092	0.092	0.098	0.098	0.100	0.102
Temp:	133	133	133	132	131	130	131	131

V<sub>test</sub> 21.68 ft/sec  
 V<sub>amb</sub> 22.34 ft/sec  
 F<sub>p</sub> 0.971

OMNI Equipment Numbers:

Elapsed Time (min)	Particulate Sampling Data										Fuel Weight (lb)										Temperature Data (F)										Stack Gas Data					
	Gas Meter 1 (ft <sup>3</sup> )	Gas Meter 2 (ft <sup>3</sup> )	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dh1 (H <sub>2</sub> O)	Orifice dh2 (H <sub>2</sub> O)	Meter 1 Vacuum (inHg)	Meter 2 Vacuum (inHg)	Dilution Tunnel (F)	Dilution Tunnel Center dp	Pro. Rate Pro. Rate 2	Scale Reading	Weight Change	Fiebox Top	Fiebox Bottom	Fiebox Back	Fiebox Left	Fiebox Right	Avg. Stove Surface (Tot=At)	Stack Exit	Stack	Filter 1	Filter 2	Driver Exit 2	Ambient	Drift (H <sub>2</sub> O)	CO <sub>2</sub> (%)	CO (%)								
133	21.482	21.150	0.16	0.16	1.26	0.94	2.23	0.94	95	1.8	118	0.103	101	100	0.2	0	489	311	446	419	390	411	815	365	82	56	85	45	84	-0.061	3.85	0.01				
134	21.645	21.310	0.16	0.16	1.26	0.95	2.22	0.95	95	1.8	118	0.105	99	99	0.2	0	488	311	445	419	390	411	815	364	83	56	85	45	83	-0.062	3.84	0.01				
135	21.808	21.470	0.16	0.16	1.26	0.94	2.23	0.94	95	1.8	118	0.103	100	100	0.2	0	486	310	444	418	389	409	816	363	83	56	85	45	83	-0.061	3.86	0.01				
136	21.970	21.630	0.16	0.16	1.25	0.94	2.22	0.94	95	1.8	118	0.099	101	102	0.2	0	485	311	443	417	389	409	816	363	84	56	86	45	83	-0.061	3.87	0.01				
137	22.133	21.790	0.16	0.16	1.26	0.94	2.23	0.94	95	1.8	118	0.099	102	102	0.1	-0.1	482	309	442	416	389	407	817	363	84	56	86	45	83	-0.061	3.87	0.01				
138	22.296	21.951	0.16	0.16	1.26	0.94	2.22	0.94	95	1.8	118	0.105	99	99	0.1	0	480	310	441	415	387	407	817	363	84	56	86	45	83	-0.061	3.92	0.01				
139	22.459	22.110	0.16	0.16	1.27	0.94	2.23	0.94	95	1.8	119	0.105	99	99	0.1	0	480	310	440	415	387	406	816	363	84	56	86	45	83	-0.061	3.81	0.01				
140	22.622	22.270	0.16	0.16	1.26	0.94	2.22	0.94	95	1.8	118	0.103	100	100	0.1	0	477	310	439	414	388	405	815	363	85	56	86	45	85	-0.061	3.81	0.01				
141	22.785	22.431	0.16	0.16	1.26	0.94	2.22	0.94	95	1.8	118	0.101	101	101	0.0	-0.1	476	310	437	413	385	404	814	362	85	56	87	45	83	-0.061	3.78	0.01				

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## Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire \_\_\_\_\_ Equipment Numbers: \_\_\_\_\_  
 Model: Nova C \_\_\_\_\_  
 Tracking No.: 2468 \_\_\_\_\_  
 Project No.: 0552WS003E \_\_\_\_\_  
 Run #: 1 \_\_\_\_\_  
 Date: 7/11/23 \_\_\_\_\_

**First Hour**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter				0.0
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:    0.0

**TRAIN 1**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	E985	123.5	118.3	5.2
C. Rear filter catch	Filter	E986	118.2	118.3	-0.1
D. Probe catch*	Probe	13	114321.5	114321.5	0.0
E. Filter seals catch*	Seals	S526	3321.0	3320.1	0.9

**Sub-Total**    Total Particulate, mg:    6.0

**Train 1 Aggregate**    Total Particulate, mg:    6.0

**TRAIN 2**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	E987	122.8	117.9	4.9
B. Rear filter catch	Filter	E988	116.3	118.1	-1.8
C. Probe catch*	Probe	35	114327.4	114327.4	0.0
D. Filter seals catch*	Seals	S527	3269.4	3269.1	0.3

**Total Particulate, mg:    3.4**

**AMBIENT**

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch*	Filter	E989	117.8	117.7	0.1

**Total Particulate, mg:    0.1**

\*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: \_\_\_\_\_

## Run 1 First Hour Emissions Data

# Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire  
 Model: Nova C  
 Project No.: 0552WS003E  
 Tracking No.: 2468  
 Run: 1  
 Test Date: 07/11/23

Technician Signature: \_\_\_\_\_

Burn Rate	<b>4.83 kg/hr dry</b>
Average Tunnel Temperature	138 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	22.23 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	13657.6 dscf/hour
Average Delta p	0.106 inches H2O
Total Time of Test	60 minutes

	AMBIENT		SAMPLE TRAIN 1		SAMPLE TRAIN 2		FIRST HOUR FILTER (TRAIN 1)	
Total Sample Volume - Vm	22.024	cubic feet	9.608	cubic feet	0.000	cubic feet	9.608	cubic feet
Average Gas Meter Temperature	83	degrees Fahrenheit	80	degrees Fahrenheit	#DIV/0!	degrees Fahrenheit	80	degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmst	21.738	dscf	9.551	dscf	#DIV/0!	dscf	9.551	dscf
Total Particulates - m <sub>p</sub>	0	mg	5.9	mg	0	mg	5.9	mg
Particulate Concentration (dry-standard) - C <sub>p</sub> /C <sub>s</sub>	0.000000	grams/dscf	0.00062	grams/dscf	#DIV/0!	grams/dscf	0.00062	grams/dscf
Total Particulate Emissions - E <sub>T</sub>	0.00	grams	8.44	grams	#DIV/0!	grams	8.44	grams
Particulate Emission Rate	0.00	grams/hour	8.44	grams/hour	#DIV/0!	grams/hour	8.44	grams/hour
Emissions Factor		grams/kg	1.75	g/kg	#DIV/0!	g/kg	2.24	g/kg
Difference from Average Total Particulate Emissions			#DIV/0!	grams	#DIV/0!	grams		
<b>Final Average Results</b>								
<b>Complete Test Run</b>								
Total Particulate Emissions - E <sub>T</sub>	#DIV/0!	grams	Filter Temps, °F	< 90	First Hour	Train 1	Train 2	Complies?
Particulate Emission Rate	#DIV/0!	grams/hour	Filter Face Velocity, fpm	< 30	88	88	88	OK
Emissions Factor	#DIV/0!	grams/kg	Dryer Exit Temp, °F	< 80	9.53	9.53	0.00	OK
			Leakage Rate, cfm	0.01	68	68	49	OK
			< 4% of avg sample rate or					
			< 0.01 cfm, lesser of the two					
			Neg. Probe Weight	=> 0				
<b>First Hour Emissions</b>								
Total Particulate Emissions - E <sub>T</sub>	8.44	grams	Pro-Rate Variation	< 90 for < 10% of θ	0.00%	0.00%	#DIV/0!	#DIV/0!
Particulate Emission Rate	8.44	grams/hour	# Readings < 80%	> 110 for < 10% of θ	1.67%	1.67%	#DIV/0!	#DIV/0!
Emissions Factor	2.24	grams/kg	# Readings > 120%		0	0	0	OK
7.5% of Average Total Particulate Emissions	#DIV/0!	grams	Ambient Temp, °F	< 55	0	0	0	OK
			(min / max)	> 90				OK
			Train Precision	(A) Within 7.5%				N/A
			One of A or B must	(B) Within 0.5 g/kg				N/A
			Stove Surface ΔT	Within 125 °F				OK
			Room Air Velocity	< 50 fpm				OK



# Wood Heater Test Data

Run: 1

Manufacturer: MF Fire  
 Model: Nova C  
 Tracking No.: 2483  
 Project No.: 00746500E  
 Date: 10/25/2017  
 Beginning Clock Time: 13:38

Total Sampling Time: 60 min  
 Recording Interval: 6 min  
 Total Volume: 22.024 cubic feet  
 Background Sample Volume: 22.024 cubic feet

PM Control Modules: 335.338  
 Dilution Tunnel MM(dry): 29.00 lbb-mole  
 Dilution Tunnel MM(wet): 28.73 lbb-mole  
 Dilution Tunnel SMO: 2.00 lbb-mole  
 Dilution Tunnel SMO: 2.00 lbb-mole  
 Tunnel Area: 0.14835 ft<sup>2</sup>  
 Pilot Tube Cp: 0.59  
 Pilot Tube Cv: 0.59

Avg. Tunnel Velocity: 22.23 ft/sec.  
 Initial Tunnel Flow: 224.3 scfm  
 Average Chamber Flow: 227.6 scfm  
 Post-Test Leak Check (1): 0.001 cfm @ 6 in. Hg  
 Post-Test Leak Check (2): 0.001 cfm @ 10 in. Hg  
 Post-Test Leak Check (3): 0.001 cfm @ 11 in. Hg  
 Average Test Piece Fuel Moisture: 19.16 Dry Basis %

Technician Signature: \_\_\_\_\_

Meter Box Y Factor:	(1)	1.015	(2)	1.012	(Amb)
Biometric Pressure:	Begin	Middle	End	Average	Room Air Velocity, [ft]
	30.08	30.03	30.03	30.05	16

Velocity Traverse Data		Fuel Weight (lb)		Temperature Data (F)		Stack Gas Data			
PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8	Center	
Initial dp	0.096	0.100	0.092	0.092	0.098	0.098	0.100	0.102	
Temp:	133	133	133	133	131	130	131	131	
V <sub>ave</sub>		21.68		fisc		22.34		fisc	
V <sub>cent</sub>		21.68		fisc		22.34		fisc	
F <sub>p</sub>		0.971		fisc		0.971		fisc	

OMNI Equipment Numbers:

Elapsed Time (min)	Gas Meter 1 (ft <sup>3</sup> )	Gas Meter 2 (ft <sup>3</sup> )	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH1 (H <sub>2</sub> O)	Orifice dH2 (H <sub>2</sub> O)	Meter 1 Vacuum (inHg)	Meter 2 Vacuum (inHg)	Dilution Tunnel Center dp	Pro. Rate 1	Pro. Rate 2	Weight Change	Fiebox Bottom	Fiebox Back	Fiebox Left	Fiebox Right	Avg. Stove Surface (Tot=At)	Stack Exit	Catalyst	Filter 1	Filter 2	Driver Exit 1	Driver Exit 2	Ambient	CO <sub>2</sub> (%)	CO (%)	DRift (H <sub>2</sub> O)	
31	5.032	0.16	0.16		2.18	80	-2.35		138	0.102	102	6.5	-0.2	854	439	471	421	498	1282	502	82	63	84	46	82	-0.077	9.67	0.71
32	5.191	0.16	0.16		2.15	80	-2.43		138	0.108	98	6.3	-0.2	854	441	473	423	489	1284	503	83	63	84	46	82	-0.076	9.56	0.76
33	5.353	0.16	0.16		2.19	80	-2.92		137	0.107	101	6.1	-0.2	853	443	475	424	500	1277	502	83	63	84	47	83	-0.077	9.52	0.67
34	5.513	0.16	0.16		2.19	80	-2.84		137	0.106	100	6.0	-0.1	851	444	476	425	500	1266	501	83	64	84	47	85	-0.076	9.52	0.52
35	5.674	0.16	0.16		2.18	80	-2.6		138	0.106	100	5.8	-0.2	856	446	477	427	502	1257	501	83	64	84	47	83	-0.075	9.43	0.44
36	5.833	0.16	0.16		2.17	80	-2.49		139	0.105	100	5.6	-0.2	852	447	479	428	502	1249	499	83	64	85	47	83	-0.075	9.25	0.35
37	5.993	0.16	0.16		2.16	80	-2.49		137	0.104	101	5.5	-0.1	849	449	480	430	503	1243	498	83	64	84	47	83	-0.075	9.29	0.3
38	6.152	0.16	0.16		2.15	80	-2.86		137	0.107	99	5.3	-0.2	853	450	481	431	504	1241	496	83	65	84	47	83	-0.076	9.18	0.25
39	6.312	0.16	0.16		2.14	80	-2.53		137	0.105	100	5.2	-0.1	851	452	484	432	505	1232	496	83	65	84	48	85	-0.076	9.13	0.21
40	6.471	0.16	0.16		2.14	80	-2.65		136	0.105	100	5.0	-0.2	846	453	485	433	505	1230	494	83	65	84	48	84	-0.075	9.12	0.17
41	6.630	0.16	0.16		2.13	80	-2.95		137	0.107	99	4.9	-0.1	844	454	486	434	505	1225	493	83	65	84	48	84	-0.075	9	0.16
42	6.789	0.16	0.16		2.12	80	-2.86		136	0.103	99	4.7	-0.2	841	456	487	436	505	1226	492	83	65	84	48	84	-0.074	8.96	0.15
43	6.945	0.16	0.16		2.11	80	-2.97		136	0.109	97	4.6	-0.1	844	457	488	438	507	1225	491	83	66	84	48	85	-0.074	8.95	0.14
44	7.102	0.16	0.16		2.09	80	-2.99		136	0.106	98	4.5	-0.1	836	458	490	438	505	1206	490	83	66	84	48	85	-0.074	8.82	0.14
45	7.259	0.16	0.16		2.08	80	-2.52		135	0.105	98	4.3	-0.2	830	460	491	439	505	1184	487	83	66	84	48	83	-0.073	8.59	0.15
46	7.416	0.16	0.16		2.09	81	-2.83		135	0.106	98	4.2	-0.1	822	460	492	440	504	1176	486	83	66	84	48	83	-0.074	8.42	0.14
47	7.572	0.16	0.16		2.08	81	-2.51		135	0.102	99	4.2	0	813	462	493	441	503	1171	485	83	66	84	48	83	-0.074	8.34	0.12
48	7.729	0.16	0.16		2.08	81	-2.6		135	0.104	98	4.0	-0.2	808	463	494	442	503	1171	484	83	66	84	48	83	-0.074	8.22	0.06
49	7.886	0.16	0.16		2.06	81	-2.57		134	0.109	96	3.8	-0.2	799	464	495	443	501	1163	482	83	67	84	48	85	-0.073	8.01	0.02
50	8.042	0.16	0.16		2.06	81	-2.85		135	0.105	97	3.7	-0.1	794	465	495	444	501	1161	481	83	67	84	48	83	-0.073	7.83	0.01
51	8.198	0.16	0.16		2.06	81	-3.05		135	0.104	98	3.6	-0.1	790	467	496	446	501	1147	479	83	67	84	48	83	-0.073	7.66	0
52	8.354	0.16	0.16		2.07	81	-2.52		134	0.104	98	3.5	-0.1	783	468	497	446	500	1132	477	83	67	85	49	82	-0.073	7.48	0
53	8.511	0.16	0.16		2.06	81	-2.98		134	0.105	98	3.4	-0.1	775	470	497	447	499	1121	474	83	67	85	49	82	-0.072	7.26	0
54	8.667	0.16	0.16		2.07	81	-2.8		133	0.107	96	3.3	-0.1	769	471	497	448	498	1108	471	83	67	85	49	83	-0.072	6.98	0
55	8.824	0.16	0.16		2.08	81	-2.74		133	0.106	97	3.2	-0.1	759	473	498	449	497	1094	467	83	67	85	49	83	-0.071	6.78	0
56	8.981	0.16	0.16		2.05	81	-3.04		133	0.104	98	3.1	-0.1	749	474	497	449	495	1099	464	83	67	85	49	84	-0.071	6.57	0
57	9.137	0.16	0.16		2.08	81	-2.82		133	0.109	95	3.0	-0.1	742	476	498	449	494	1052	461	83	68	85	49	84	-0.070	6.45	0
58	9.294	0.16	0.16		2.08	81	-2.99		132	0.106	97	2.9	-0.1	729	477	499	449	492	1038	458	84	68	85	49	84	-0.071	6.45	0
59	9.451	0.16	0.16		2.09	81	-2.97		132	0.107	97	2.8	-0.1	723	479	498	450	491	1062	455	84	68	85	49	83	-0.070	6.36	0
60	9.608	0.16	0.16		2.08	81	-2.91		131	0.111	95	2.8	0	714	480	498	450	489	1091	452	84	68	85	49	84	-0.070	6.26	0

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## Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire \_\_\_\_\_ Equipment Numbers: \_\_\_\_\_  
 Model: Nova C \_\_\_\_\_  
 Tracking No.: 2468 \_\_\_\_\_  
 Project No.: 0552WS003E \_\_\_\_\_  
 Run #: 1 \_\_\_\_\_  
 Date: 7/11/23 \_\_\_\_\_

**First Hour**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	E983	122.8	117.6	5.2
C. Rear filter catch	Filter	E984	119.3	119.2	0.1
D. Probe catch*	Probe	24	114128.5	114128.5	0.0
E. Filter seals catch*	Seals	S525	3283.2	3282.6	0.6

**Sub-Total**    Total Particulate, mg:    5.9

**TRAIN 1**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter				0.0
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:    0.0

**Train 1 Aggregate**    Total Particulate, mg:    5.9

**TRAIN 2**

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

**Total Particulate, mg:    0.0**

**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: \_\_\_\_\_

# OMNI-Test Laboratories

**Manufacturer:** MF Fire  
**Model:** Nova C  
**Date:** 07/11/23  
**Run:** 1  
**Control #:**  
**Test Duration:** 141  
**Output Category:** SBR

**Technicians:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## Test Results in Accordance with CSA B415.1-10

	HHV Basis	LHV Basis
Overall Efficiency	68.3%	73.8%
Combustion Efficiency	97.5%	97.5%
Heat Transfer Efficiency	70%	75.7%

Output Rate (kJ/h)	27,836	26,405	(Btu/h)
Burn Rate (kg/h)	2.06	4.54	(lb/h)
Input (kJ/h)	40,764	38,669	(Btu/h)

Test Load Weight (dry kg)	4.84	10.66	dry lb
MC wet (%)	16.08		
MC dry (%)	19.16		
Particulate (g)	0		
CO (g)	200		
Test Duration (h)	2.35		

Emissions	Particulate	CO
g/MJ Output	0.00	3.06
g/kg Dry Fuel	0.00	41.33
g/h	0.00	85.05
lb/MM Btu Output	0.00	7.10

Air/Fuel Ratio (A/F)	16.43
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VERSION:

2.4

4/15/2010

VERSION: 2.4 4/15/2010

Manufacturer: MF Fire  
 Model: Nova C  
 Date: 7/11/2023  
 Run: 1  
 Control #:   
 Test Duration: 141  
 Output Category: SBR

Appliance Type: Cat (Cat, Non-Cat, Pellet)

Temp. Units F (F or C)  
 Weight Units lb (kg or lb)

**Default Fuel Values**

	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

Wood Moisture (% wet): 16.08  
 Load Weight (lb wet): 12.70  
 Burn Rate (dry kg/h): 2.06  
 Total Particulate Emissions: g

**Fuel Data**

	D. Fir	kJ/kg
HHV	19,810	
%C	48.73	
%H	6.87	
%O	43.9	
%Ash	0.5	

Note 1: For other fuels, use the heating value and fuel composition determined by analysis of fuel sample in accordance with Clause 9.2.

Averages 0.17 6.37 #DIV/0! 425.48 83.23

Elapsed Time (min)	Fuel Weight Remaining (lb)	Flue Gas Composition (%)			Temp. (°F)	
		CO	CO <sub>2</sub>	O <sub>2</sub>	Flue Gas	Room Temp
0	12.70	0.25	4.19		429.0	85.0
1	12.50	0.23	1.75		402.0	84.0
2	12.40	0.03	3.67		400.0	85.0
3	12.30	0.03	5.05		405.0	84.0
4	12.20	0.01	8.85		411.0	84.0
5	12.00	0.01	9.08		418.0	85.0
6	11.80	1.10	12.01		431.0	83.0
7	11.60	0.19	10.95		442.0	81.0
8	11.30	1.00	11.97		452.0	83.0
9	11.10	0.94	11.89		459.0	82.0
10	10.90	0.85	11.96		465.0	84.0
11	10.70	0.58	11.78		469.0	84.0
12	10.40	0.63	9.65		474.0	82.0
13	10.20	0.64	9.57		478.0	81.0
14	10.00	0.66	9.70		482.0	82.0
15	9.80	0.74	9.59		485.0	84.0
16	9.60	0.73	9.66		489.0	83.0
17	9.30	0.73	9.71		492.0	82.0
18	9.10	0.71	9.67		493.0	83.0
19	8.90	0.71	9.72		495.0	83.0
20	8.70	0.71	9.73		496.0	84.0
21	8.50	0.77	9.78		498.0	85.0
22	8.30	0.75	9.78		498.0	83.0
23	8.10	0.74	9.76		500.0	84.0
24	7.90	0.76	9.76		500.0	84.0
25	7.70	0.75	9.80		500.0	83.0
26	7.50	0.69	9.70		501.0	83.0
27	7.30	0.69	9.87		501.0	84.0
28	7.10	0.64	9.89		502.0	85.0
29	6.90	0.64	9.80		503.0	84.0
30	6.70	0.59	9.66		503.0	84.0
31	6.50	0.71	9.67		502.0	82.0
32	6.30	0.76	9.56		503.0	82.0
33	6.10	0.67	9.52		502.0	83.0
34	6.00	0.52	9.52		501.0	85.0
35	5.80	0.44	9.43		501.0	83.0
36	5.60	0.35	9.25		499.0	83.0
37	5.50	0.30	9.29		498.0	83.0
38	5.30	0.25	9.18		496.0	83.0
39	5.20	0.21	9.13		496.0	85.0
40	5.00	0.17	9.12		494.0	84.0
41	4.90	0.16	9.00		493.0	84.0
42	4.70	0.15	8.96		492.0	84.0
43	4.60	0.14	9.05		491.0	85.0
44	4.50	0.14	8.82		490.0	85.0
45	4.30	0.15	8.59		487.0	83.0
46	4.20	0.14	8.42		486.0	83.0
47	4.20	0.12	8.34		485.0	83.0
48	4.00	0.06	8.22		484.0	83.0
49	3.80	0.02	8.01		482	85
50	3.70	0.01	7.83		481	83
51	3.60	0	7.66		479	83
52	3.50	0	7.48		477	82
53	3.40	0	7.26		474	82
54	3.30	0	6.98		471	83

Note 2: In cases where the "Fuel Weight Remaining" is the same for three or more readings in a row, a "divide by zero error" will occur in the calculation sheet. In such cases, adjust the weight values by interpolation between the first occurrence and the next reading showing a decrease in weight.

55	3.20	0	6.78	467	83
56	3.10	0	6.57	464	84
57	3.00	0	6.45	461	84
58	2.90	0	6.45	458	84
59	2.80	0	6.36	455	83
60	2.80	0	6.26	452	84
61	2.70	0	5.94	449	83
62	2.60	0	4.86	444	84
63	2.70	0	4.72	440	84
64	2.50	0	4.63	436	84
65	2.50	0	4.58	433	83
66	2.40	0	4.4	431	84
67	2.40	0	4.33	427	85
68	2.30	0	4.28	424	82
69	2.30	0	4.29	421	83
70	2.20	0	4.19	418	84
71	2.20	0	4.1	416	83
72	2.10	0	4.05	413	83
73	2.20	0	4	412	83
74	2.10	0.01	3.98	409	83
75	2.00	0.01	3.98	408	83
76	2.00	0.01	3.97	405	82
77	2.00	0.01	3.98	403	83
78	1.90	0.01	4	402	83
79	1.90	0.01	4.13	401	82
80	1.90	0.01	4.15	400	83
81	1.80	0.01	4.23	398	82
82	1.80	0.01	4.09	395	83
83	1.80	0.01	4.16	395	83
84	1.70	0.01	4.25	393	83
85	1.70	0.01	4.73	393	83
86	1.70	0	4.82	391	82
87	1.70	0	4.93	390	82
88	1.60	0	5	388	83
89	1.50	0	5.02	387	82
90	1.50	0	5.03	386	84
91	1.50	0	5	385	83
92	1.50	0	5.02	384	82
93	1.40	0	5.01	384	83
94	1.40	0	5.05	382	85
95	1.30	0	5.11	382	83
96	1.30	0	5.06	381	82
97	1.30	0	5.06	381	82
98	1.20	0	4.93	382	83
99	1.20	0	4.96	381	83
100	1.20	0	4.94	379	82
101	1.10	0	4.94	379	83
102	1.10	0	4.97	378	83
103	1.10	0	4.9	378	83
104	1.00	0	4.88	377	83
105	1.00	0	4.91	377	83
106	1.00	0	4.87	376	83
107	0.90	0	4.89	375	83
108	0.90	0	4.87	375	83
109	0.90	0	4.87	375	83
110	0.90	0	4.92	375	84
111	0.80	0	4.96	375	84
112	0.80	0	4.88	374	84
113	0.80	0	4.91	374	83
114	0.80	0	4.91	373	84
115	0.70	0.01	4.87	374	83
116	0.70	0.01	4.83	372	83
117	0.70	0.01	4.81	371	83
118	0.60	0.01	4.81	372	83
119	0.60	0.01	4.74	372	83
120	0.60	0.01	4.72	372	82
121	0.60	0.01	4.73	371	83
122	0.50	0.01	4.7	371	83
123	0.50	0.01	4.64	371	82
124	0.40	0.01	4.68	371	83
125	0.40	0.01	4.65	370	85
126	0.40	0.01	4.61	369	83
127	0.40	0.01	4.61	370	83
128	0.40	0.01	4.58	369	83

129	0.30	0.01	4.58		369	84
130	0.40	0.01	4.56		368	83
131	0.30	0	3.99		367	83
132	0.20	0.01	3.86		366	82
133	0.20	0.01	3.85		365	84
134	0.20	0.01	3.84		364	83
135	0.20	0.01	3.86		363	83
136	0.20	0.01	3.87		363	83
137	0.10	0.01	3.87		363	83
138	0.10	0.01	3.92		363	83
139	0.10	0.01	3.81		363	83
140	0.10	0.01	3.81		363	85
141	0.00	0.01	3.78		362	83

Client: MF FIRE \_\_\_\_\_ Project Number: 0552WS003E \_\_\_\_\_ Run Number: 1 \_\_\_\_\_

Model: NOVA C \_\_\_\_\_ Tracking Number: 2468 \_\_\_\_\_ Date: 7/11/2023 \_\_\_\_\_

Test Crew: RT \_\_\_\_\_

OMNI Equipment ID numbers: \_\_\_\_\_

**Wood Heater Run Notes**

**Air Control Settings**

Primary:

Secondary: N/A

*N/A Single Burn rate*

Tertiary/Pilot: N/A

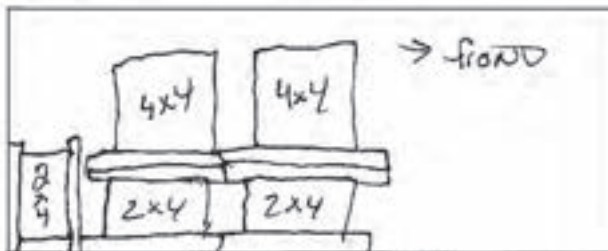
Fan: N/A

**Preburn Notes**

Time	Notes
1141	At 2.3 lbs startup PB was loaded
1240	59 min into pre burn, additional 8.0 lbs of preburn fuel was added due to being outside the coal bed range Three pre burn moisture readings: 19.1, 21.6, 23.0.
1357	At 3.1 lbs fuel was leveled

**Test Notes**

Sketch test fuel configuration:



Start up procedures & Timeline:

Bypass: Used  
 Fuel loaded by: 35  
 Door closed at: 40  
 Primary air: N/A

Notes: \_\_\_\_\_

Time	Notes
1338	test start
1438	First hour sampling stopped
1600	test done

Technician Signature: *[Signature]*

Date: 07-11-2023

### ASTM E2780 Wood Heater Run Sheets

Client: MF FIRE Project Number: 0552WS003E Run Number: 1  
 Model: NOVA C Tracking Number: 2468 Date: 7/11/2023  
 Test Crew: RT  
 OMNI Equipment ID numbers: \_\_\_\_\_

#### Wood Heater Supplemental Data

Start Time: 13:38 Booth #: \_\_\_\_\_

Stop Time: 15:59

**Stack Gas Leak Check:**

Initial:  Final:

**Sample Train Leak Check:**

A: 0.001 @ 10.08 Hg  
 B: 0.001 @ 11.02 Hg  
 1st 0.000 6.07

Calibrations: Span Gas CO<sub>2</sub>: 16.84 CO: 4.38

	Pre Test		Post Test	
	Zero	Span	Zero	Span
Time	1131	1132	1606	1601
CO <sub>2</sub>	0.00	16.84	0.02	<del>16.657</del> 16.74
CO	0.00	4.38	-0.005	4.35

CO ppm 0.00 4.38 0 4.35

Air Velocity (ft/min): Initial: 150 Final: 150

Scale Audit (lbs): Initial: 10.0 Final: 10.0

Pitot Tube Leak Test: Initial:  Final:

Stack Diameter (in): 6

Induced Draft: None

% Smoke Capture: 100%

Flue Pipe Cleaned Prior to First Test in Series:

Date: 07/10/2023 Initials: RT

	Initial	Middle	Ending
P <sub>b</sub> (in/Hg)	30.08	30.04	30.03
RH (%)	45	38	37
Ambient (°F)	87	83	83

Sample 00372,

Background Filter Volume: see Raw Data

Technician Signature: [Signature]

Tunnel Traverse		
Microtector Reading	dP (in H <sub>2</sub> O)	T(°F)
1	0.048	0.096 133
2	0.050	0.100 133
3	0.046	0.092 133
4	0.046	0.092 133
5	0.046	0.092 132
6	0.049	0.098 131
7	0.049	0.098 130
8	0.050	0.100 131
Center:		
0.051	0.102	131

Tunnel Static Pressure (in H <sub>2</sub> O):	
Beginning of Test	End of Test
-0.100	-0.100

Date: 7-11-2023

### ASTM E2780 Wood Heater Run Sheets

Client: MF FIRE Project Number: 0552WS003E Run Number: 1  
 Model: NOVA C Tracking Number: 2468 Date: 7/11/2023  
 Test Crew: RT  
 OMNI Equipment ID numbers: \_\_\_\_\_

#### Wood Heater Fuel Data

Fuel: Douglas fir, untreated and air dried, standard grade or better dimensional lumber

Pre-Burn Fuel					
<b>Calibration:</b>		Cal Value (1) = 12%	Actual Reading	<u>12.0</u>	
		Cal Value (2) = 22%	Actual Reading	<u>22.0</u>	
Piece:	Length:	Reading:	Piece:	Length:	Reading:
1	<u>10</u> in	<u>18.8</u>	7	<u>14</u> in	<u>20.6</u>
2	<u>10</u> in	<u>20.0</u>	8	<u>14</u> in	<u>19.7</u>
3	<u>10</u> in	<u>19.0</u>	9	_____ in	_____
4	<u>10</u> in	<u>20.1</u>	10	_____ in	_____
5	<u>14</u> in	<u>19.5</u>	11	_____ in	_____
6	<u>14</u> in	<u>20.3</u>	12	_____ in	_____
Total Pre-Burn Fuel Weight: <u>297.8 lbs</u>			Pre-Burn Fuel Average Moisture: <u>19.9%</u>		
Time (clock): <u>0908</u>		Room Temperature (F): <u>76.0</u>		Initials: <u>RT</u>	

Test Fuel					
Firebox Volume (ft <sup>3</sup> ):		<u>1.70</u>	<u>10.8</u>	Test Fuel Piece Length (in): <u>14.0</u>	
Load Weight Range (lb):		<u><del>11.2-12.6</del></u>	<u>13.0</u>	Total Wet Fuel Load Weight (lb): <u>12.7</u>	
Fuel Type & Amount:		2 x 4: <u>3</u>	4 x 4: <u>2</u>	<u>2.6-3.1</u>	
Weight (with spacers):		<u>5.1</u>	Weight (with spacers):	<u>7.6</u>	
Piece:	Weight (lbs):	Moisture Readings (%DB):			Fuel Type:
1	<u>1.6</u> <u>1.2</u>	<u>19.6</u>	<u>21</u>	<u>19.7</u>	<u>2x4</u>
2	<u>1.7</u> <u>1.3</u>	<u>19.9</u>	<u>20.6</u>	<u>19.8</u>	<u>2x4</u>
3	<u>1.8</u> <u>1.4</u>	<u>20.6</u>	<u>22.2</u>	<u>19.9</u>	<u>2x4</u>
4	<u>4.0</u> <u>3.8</u>	<u>22.3</u>	<u>19.4</u>	<u>19.2</u>	<u>4x4</u>
5	<u>3.5</u> <u>3.3</u>	<u>22</u>	<u>19.9</u>	<u>22.0</u>	<u>4x4</u>
6	_____	_____	_____	_____	_____
7	_____	_____	_____	_____	_____
Spacer Moisture Readings (%DB)					
<u>10.4</u>	<u>10.6</u>	<u>9.4</u>	<u>8.5</u>	_____	_____
<u>10.5</u>	<u>8.4</u>	<u>12.0</u>	<u>11.4</u>	_____	_____
<u>12.4</u>	<u>7.5</u>	<u>12.2</u>	<u>9.7</u>	_____	_____
<u>11.4</u>	<u>9.2</u>	<u>12.0</u>	<u>11.2</u>	_____	_____
Time (clock): <u>1040</u>		Room Temperature (F): <u>76</u>		Initials: <u>RT</u>	

Technician Signature: [Signature]

Date: 7-11-23



### ASTM E2780 Wood Heater Run Sheets

Client: MF FIRE Project Number: 0552WS003E Run Number: 1  
 Model: NOVA C Tracking Number: 2468 Date: 7/11/2023  
 Test Crew: RT  
 OMNI Equipment ID numbers: \_\_\_\_\_

#### ASTM E2515 Lab Sheet

Assembled By:

Riley Ticeps

Date/Time in Dessicator:

7-11-2023

Weighing #1	Weighing #2	Weighing #3	Weighing #4	Weighing #5	
Date/Time: 7-11-23	Date/Time: 7-12-23	Date/Time: 7-13-2023	Date/Time: 7-17-23	Date/Time: 7-19-23	7-24-23
R/H %: 15.1	R/H %: 11.0	R/H %: 17.1	R/H %: 16.4	R/H %: 17.1	10.7
Temp: 75.9	Temp: 76.1	Temp: 76.4	Temp: 77.5	Temp: 77.8	78.0
200 mg Audit: 200.0	200 mg Audit: 200.1	200 mg Audit: 200.1	200 mg Audit: 200.1	200 mg Audit: 200.1	199.9
2 g Audit: 2000.2	2 g Audit: 2000.3	2 g Audit: 2000.3	2 g Audit: 2000.5	2 g Audit: 2000.3	2000.1
100 g Audit: 99998.0	100 g Audit: 99997.9	100 g Audit: 99997.9	100 g Audit: 99997.9	100 g Audit: 99997.8	99997.8
Initials: RT	Initials: RT	Initials: RT	Initials: RT	Initials: RT	RT

Train	Element	ID #	Tare (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)
A (First Hour)	Front Filter	E983	117.6 ✓	122.8	122.8	122.8 ✓		
	Rear Filter	E984	119.2 ✓	119.9	119.4	119.3 ✓		
	Probe	24	114128.5 ✓	114129.7	114129.0	114128.5	114128.5 ✓	
	O-Ring Set	5525	3282.6 ✓	3285.9	3283.4	3283.2 ✓		3282.7
A (Remainder)	Front Filter	E985	118.3 ✓	123.8	123.7	123.5 ✓		
	Rear Filter	E986	118.3 ✓	118.3	118.4	118.2 ✓		
	Probe	13	114321.5 ✓	114321.7	114321.7	114321.5 ✓		
	O-Ring Set	5526	3320.1 ✓	3322.8	3321.0	3321.0 ✓		3320.1
B	Front Filter	E987	117.9 ✓	123.2	122.8	122.8 ✓		
	Rear Filter	E988	118.1 ✓	116.1	116.3	116.3 ✓		
	Probe	35	114327.4 ✓	114327.8	114327.6	114327.4 ✓		
	O-Ring Set	5527	3269.1 ✓	3273.6	3271.7	3271.6 ✓	5270.9	3270.7 ✓
BG	Filter	E989	117.7 ✓	117.8	117.8 ✓			

Technician Signature: Riley Ticeps

Date: 7-11-2023

## Run 2 Test Data

# Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire  
 Model: NovaC  
 Project No.: 0552WS003E  
 Tracking No.: 2468  
 Run: 2  
 Test Date: 07/12/23

Technician Signature: \_\_\_\_\_

Burn Rate	<b>1.98 kg/hr dry</b>
Average Tunnel Temperature	126 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	22.83 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	14309.7 dscf/hour
Average Delta p	0.107 inches H2O
Total Time of Test	140 minutes

	AMBIENT		SAMPLE TRAIN 1		SAMPLE TRAIN 2		FIRST HOUR FILTER (TRAIN 1)	
	Value	Requirement	Value	Requirement	Value	Requirement	Value	Requirement
Total Sample Volume - Vm	22.024 cubic feet		22.669 cubic feet		22.231 cubic feet		9.566 cubic feet	
Average Gas Meter Temperature	84 degrees Fahrenheit		90 degrees Fahrenheit		91 degrees Fahrenheit		87 degrees Fahrenheit	
Total Sample Volume (Standard Conditions) - Vmst	21.708 dscf		22.063 dscf		21.741 dscf		9.370 dscf	
Total Particulates - m <sub>p</sub>	0 mg		3 mg		2.9 mg		0 mg	
Particulate Concentration (dry-standard) - C <sub>p</sub> /C <sub>s</sub>	0.000000 grams/dscf		0.00014 grams/dscf		0.00013 grams/dscf		0.00000 grams/dscf	
Total Particulate Emissions - E <sub>T</sub>	0.00 grams		4.54 grams		4.45 grams		0.00 grams	
Particulate Emission Rate	0.00 grams/hour		1.95 grams/hour		1.91 grams/hour		0.00 grams/hour	
Emissions Factor			0.98 g/kg		0.97 g/kg		0.00 g/kg	
Difference from Average Total Particulate Emissions			0.04 grams		0.04 grams		0.04 grams	
<b>Final Average Results</b>								
<b>Complete Test Run</b>								
Total Particulate Emissions - E <sub>T</sub>	4.50 grams		Filter Temps, °F	< 90	86	Train 1	88	Train 2
Particulate Emission Rate	<b>1.93 grams/hour</b>		Filter Face Velocity, fpm	< 30	8.78	8.84	9.59	OK
Emissions Factor	0.97 grams/kg		Dryer Exit Temp, °F	< 80	59	61	53	OK
			Leakage Rate, cfm	0.01	0.000	0.001	0.001	OK
			< 4% of avg sample rate or					
			< 0.01 cfm, lesser of the two					
<b>First Hour Emissions</b>			Neg. Probe Weight	=> 0	0	0	0	OK
Total Particulate Emissions - E <sub>T</sub>	0.00 grams		Pro-Rate Variation	< 90 for < 10% of θ	0.00%	0.00%	0.00%	OK
Particulate Emission Rate	0.00 grams/hour		# Readings < 80%	> 110 for < 10% of θ	0.00%	0.00%	2.14%	OK
Emissions Factor	0.00 grams/kg		# Readings > 120%		0	0	0	OK
7.5% of Average Total Particulate Emissions	0.34 grams		Ambient Temp, °F	< 55	0	0	0	OK
			(min / max)	> 90				OK
			Train Precision	(A) Within 7.5%				OK
			One of A or B must	(B) Within 0.5 g/kg				OK
			Stove Surface ΔT	Within 125 °F				OK
			Room Air Velocity	< 50 fpm				OK

## Wood Heater Preburn Data - ASTM E2780

**Run: 2**

Technician Signature \_\_\_\_\_

Manufacturer: MF Fire  
 Model: NovaC  
 Tracking No.: 2468  
 Project No.: 0552WS003E  
 Test Date: 7/12/23

Beginning Clock Time: \_\_\_\_\_

Preburn Fuel Data					
4 pieces @	14 inches				
3 pieces @	10 inches				
1 pieces @	6 inches				
Fuel Moisture Readings (% DB):					
		23.1	22.6		
		22.5	21.7		
		20	21.9		
		21			
		22.1			
Avg Preburn Moisture (% DB):		<b>21.86</b>			

Coal Bed	<b>2.4</b>	<b>3.1</b>
Range (lb):	(min)	(max)

Elapsed Time (min)	Scale (lb)	Stack Draft (in H <sub>2</sub> O)	Temperatures (°F)								
			FB Top	FB Bottom	FB Back	FB Left	FB Right	Cat Exit	Avg. FB	Stack	Ambient
0	4.7	-0.068	487	144	352	309	278	575	314	431	77
1	9.6	-0.068	471	146	357	314	281	613	313.9	442	78
2	9.4	-0.071	477	149	360	316	284	968	317	413	79
3	9.5	-0.079	489	151	360	319	287	1020	321.1	412	77
4	9.2	-0.073	507	153	359	321	289	1069	325.9	415	78
5	9	-0.073	528	155	357	322	292	1013	330.8	414	77
6	8.9	-0.073	539	157	355	323	294	1001	333.5	414	76
7	8.7	-0.072	548	158	353	325	297	995	336.1	414	78
8	8.6	-0.073	559	160	351	326	299	1021	338.9	417	77
9	8.4	-0.073	569	162	349	328	301	1017	341.7	419	78
10	8.3	-0.074	581	163	347	329	303	1024	344.8	422	78
11	8.1	-0.074	583	165	345	331	306	1051	345.8	422	78
12	8	-0.074	590	166	344	333	308	1060	348.1	423	78
13	7.8	-0.073	594	168	343	335	309	1029	349.9	422	78
14	7.7	-0.073	594	170	342	337	312	1019	350.9	422	78
15	7.6	-0.073	596	171	341	338	313	1024	352	422	78
16	7.4	-0.073	600	172	340	339	314	1023	353.2	423	80
17	7.3	-0.074	600	175	340	342	316	1039	354.5	425	79
18	7.1	-0.074	611	176	340	343	317	1045	357.4	427	81
19	7	-0.074	619	178	340	345	319	1052	360	428	83
20	6.8	-0.074	622	179	340	347	320	1067	361.7	430	83
21	6.7	-0.074	629	181	341	348	322	1080	364.2	432	79
22	6.5	-0.074	638	183	341	350	324	1090	367.1	434	79
23	6.3	-0.074	647	184	342	352	326	1094	370.2	436	79
24	6.2	-0.074	653	186	344	354	327	1112	372.9	438	79
25	6	-0.075	660	188	345	356	329	1119	375.8	440	80
26	5.9	-0.075	666	190	347	359	331	1118	378.5	441	80
27	5.7	-0.074	676	192	349	361	334	1115	382.4	443	81
28	5.6	-0.074	682	193	351	364	336	1118	385.2	444	80
29	5.2	-0.074	688	195	353	366	339	1125	388.4	446	80
30	5.1	-0.074	693	197	356	369	342	1130	391.2	441	83
31	4.9	-0.074	693	198	359	372	344	1130	393.1	440	82
32	4.8	-0.074	704	200	362	374	347	1132	397.3	441	83
33	4.6	-0.075	702	202	364	378	349	1138	399.1	440	83
34	4.5	-0.074	711	204	367	380	351	1144	402.8	442	82
35	4.4	-0.075	712	206	370	383	354	1151	405.2	442	80
36	4.2	-0.075	720	208	373	386	357	1161	408.8	442	79
37	4.1	-0.074	715	210	376	390	360	1162	409.9	442	79
38	4	-0.074	720	212	379	392	362	1177	413	443	79
39	3.9	-0.075	721	213	381	395	364	1190	415	444	79
40	3.7	-0.074	727	215	384	398	366	1202	418.2	444	79
41	3.6	-0.074	728	217	387	401	368	1207	420.3	444	79
42	3.5	-0.074	730	219	390	403	370	1200	422.6	443	82

## Wood Heater Preburn Data - ASTM E2780

**Run: 2**

Technician Signature \_\_\_\_\_

Manufacturer: MF Fire  
 Model: NovaC  
 Tracking No.: 2468  
 Project No.: 0552WS003E  
 Test Date: 7/12/23

Beginning Clock Time: \_\_\_\_\_

Preburn Fuel Data					
4 pieces @	14 inches				
3 pieces @	10 inches				
1 pieces @	6 inches				
Fuel Moisture Readings (% DB):					
		23.1	22.6		
		22.5	21.7		
		20	21.9		
		21			
		22.1			
Avg Preburn Moisture (% DB):		<b>21.86</b>			

Coal Bed	<b>2.4</b>	<b>3.1</b>
Range (lb):	(min)	(max)

Elapsed Time (min)	Scale (lb)	Stack Draft (in H <sub>2</sub> O)	Temperatures (°F)								
			FB Top	FB Bottom	FB Back	FB Left	FB Right	Cat Exit	Avg. FB	Stack	Ambient
43	3.4	-0.074	730	221	393	406	373	1185	424.6	443	83
44	3.3	-0.074	729	222	397	408	375	1168	426.3	442	82
45	3.2	-0.073	727	224	400	410	377	1159	427.6	441	81
46	5.3	-0.081	726	226	404	413	379	1184	429.6	453	82
47	2.9	-0.073	709	229	409	414	380	1107	428.3	463	82
48	2.9	-0.073	705	231	414	416	382	1112	429.5	449	82
49	2.8	-0.073	696	232	418	419	383	1065	429.7	440	81
50	2.8	-0.072	682	234	421	421	385	1029	428.8	435	83
51	2.7	-0.071	665	236	425	423	386	1007	427	429	81
52	2.7	-0.07	653	238	427	424	387	985	425.8	424	82
53	2.6	-0.071	639	238	428	426	388	967	423.7	419	81
54	2.6	-0.07	628	241	429	426	389	950	422.6	416	81
55	2.5	-0.069	615	242	430	426	388	936	420.3	412	82
56	2.5	-0.069	606	243	430	427	388	925	418.9	409	82
57	2.5	-0.069	591	245	429	427	389	914	416.3	405	82
58	2.4	-0.068	585	247	428	426	388	908	414.9	401	83
59	2.3	-0.068	570	249	427	425	388	903	411.8	399	82
60	2.3	-0.068	560	249	425	424	387	896	409	396	82
61	2.3	-0.068	555	251	423	422	386	888	407.5	393	81
62	2.3	-0.067	543	253	421	422	385	866	404.6	390	80
63	2.2	-0.068	537	255	419	420	384	864	402.7	386	80
64	2.2	-0.067	529	255	416	418	383	869	400.2	384	82
65	2.1	-0.067	522	257	414	416	381	864	398.1	382	83
66	2.1	-0.067	511	258	412	414	380	859	395.2	380	81
67	2.1	-0.066	509	259	409	412	379	852	393.5	377	81
68	2.1	-0.066	504	260	406	410	377	839	391.6	375	82
69	2	-0.065	496	261	404	408	376	827	388.9	372	81
70	2	-0.064	491	262	401	406	373	819	386.6	369	80
71	2	-0.064	488	263	398	404	373	812	385.2	366	79
72	1.9	-0.065	482	264	396	402	371	807	382.7	364	78
73	1.9	-0.065	478	266	393	399	369	803	380.9	362	79
74	1.9	-0.065	471	267	391	397	368	799	378.5	360	81
75	1.9	-0.064	467	267	388	395	366	794	376.6	358	81
76	1.9	-0.064	463	268	386	393	364	789	374.7	356	82
77	1.8	-0.064	457	269	383	391	362	785	372.5	354	82
78	1.8	-0.064	456	270	381	388	361	779	371.2	352	82
79	1.8	-0.063	452	270	379	386	360	775	369.2	351	82
80	1.7	-0.063	448	271	377	384	358	771	367.6	349	81
81	1.7	-0.063	447	272	374	382	357	767	366.3	348	83
82	1.7	-0.063	440	273	372	381	355	765	364.2	346	81
83	1.7	-0.063	435	273	370	379	354	762	362.3	344	82
84	1.6	-0.062	435	274	368	377	352	755	361.3	342	83
85	1.6	-0.063	434	274	366	376	350	750	360.2	342	82

## Wood Heater Preburn Data - ASTM E2780

**Run: 2**

Technician Signature \_\_\_\_\_

Manufacturer: MF Fire  
 Model: NovaC  
 Tracking No.: 2468  
 Project No.: 0552WS003E  
 Test Date: 7/12/23

Beginning Clock Time: \_\_\_\_\_

Preburn Fuel Data					
4 pieces @	14 inches				
3 pieces @	10 inches				
1 pieces @	6 inches				
Fuel Moisture Readings (% DB):					
		23.1	22.6		
		22.5	21.7		
		20	21.9		
		21			
		22.1			
Avg Preburn Moisture (% DB):		<b>21.86</b>			

Coal Bed	<b>2.4</b>	<b>3.1</b>
Range (lb):	(min)	(max)

Elapsed Time (min)	Scale (lb)	Stack Draft (in H <sub>2</sub> O)	Temperatures (°F)								
			FB Top	FB Bottom	FB Back	FB Left	FB Right	Cat Exit	Avg. FB	Stack	Ambient
86	1.6	-0.062	431	275	364	374	349	747	358.6	340	83
87	1.6	-0.062	428	274	363	372	347	742	356.6	338	81
88	1.6	-0.062	425	276	361	370	346	727	355.6	336	82
89	3.1	-0.067	418	276	360	369	344	709	353.6	343	82
90	11	-0.059	408	277	360	368	343	554	351.4	345	81
91	10.9	-0.063	402	277	360	367	342	690	349.7	333	80
92	10.9	-0.064	397	277	358	364	341	751	347.5	332	83
93	10.8	-0.064	394	277	355	363	339	760	345.7	332	82
94	10.7	-0.065	391	278	352	361	338	775	343.9	335	81
95	10.6	-0.066	393	278	348	358	336	820	342.5	342	82
96	10.5	-0.067	394	277	344	356	334	800	340.9	345	81
97	10.4	-0.067	393	277	341	353	332	836	339.3	349	82
98	10.4	-0.067	392	277	338	351	330	843	337.6	351	79
99	10.3	-0.068	395	277	335	349	329	876	336.9	356	82
100	10.7	-0.063	397	277	332	346	327	886	335.7	361	81
101	9.9	-0.069	399	277	330	344	325	860	335.1	367	81
102	9.8	-0.07	403	277	328	341	323	896	334.7	370	81
103	9.7	-0.07	409	278	326	339	321	877	334.7	370	80
104	9.6	-0.07	410	278	325	336	320	886	333.9	371	81
105	9.5	-0.07	417	277	323	336	319	904	334.5	373	81
106	9.3	-0.07	418	278	322	334	318	922	334	375	80
107	9.2	-0.071	433	278	321	331	317	953	336.1	379	80
108	9.1	-0.072	449	279	320	330	316	991	338.7	384	80
109	8.9	-0.073	464	278	319	329	316	1029	341.1	388	80
110	8.7	-0.073	485	279	319	327	316	1063	344.9	396	81
111	8.6	-0.074	493	279	318	326	316	1069	346.6	400	79
112	8.4	-0.074	500	280	318	325	316	1042	347.7	402	80
113	8.3	-0.074	505	280	318	325	317	1054	348.7	405	81
114	8	-0.074	516	280	318	323	318	1062	351.2	407	80
115	7.8	-0.075	528	280	319	324	319	1075	353.9	410	81
116	7.7	-0.075	533	280	320	324	320	1075	355.6	412	80
117	7.6	-0.08	542	281	320	325	322	1073	358.1	422	80
118	7.5	-0.074	545	282	321	326	323	1063	359.3	419	80
119	7.4	-0.073	550	282	322	327	324	1073	360.9	420	81
120	7.2	-0.074	556	281	322	328	326	1063	362.7	419	80
121	7.1	-0.074	560	283	322	330	327	1060	364.4	420	81
122	6.9	-0.074	564	282	323	330	328	1054	365.6	420	80
123	6.8	-0.074	566	282	323	332	329	1045	366.5	419	80
124	6.7	-0.074	570	283	323	334	330	1053	368	418	80
125	6.5	-0.075	573	283	324	335	331	1067	369.2	418	80
126	6.4	-0.074	589	284	324	336	332	1093	373.1	419	81
127	6.2	-0.075	597	283	325	338	332	1089	375.1	421	82
128	6.1	-0.074	606	284	326	340	333	1095	377.8	422	81

## Wood Heater Preburn Data - ASTM E2780

**Run: 2**

Technician Signature \_\_\_\_\_

Manufacturer: MF Fire  
 Model: NovaC  
 Tracking No.: 2468  
 Project No.: 0552WS003E  
 Test Date: 7/12/23

Beginning Clock Time: \_\_\_\_\_

Preburn Fuel Data					
4 pieces @	14 inches				
3 pieces @	10 inches				
1 pieces @	6 inches				
Fuel Moisture Readings (% DB):					
			23.1	22.6	
			22.5	21.7	
			20	21.9	
			21		
			22.1		
Avg Preburn Moisture (% DB):			<b>21.86</b>		

Coal Bed	<b>2.4</b>	<b>3.1</b>
Range (lb):	(min)	(max)

Elapsed Time (min)	Scale (lb)	Stack Draft (in H <sub>2</sub> O)	Temperatures (°F)								
			FB Top	FB Bottom	FB Back	FB Left	FB Right	Cat Exit	Avg. FB	Stack	Ambient
129	5.9	-0.074	621	284	328	342	334	1102	381.9	423	81
130	5.8	-0.074	628	285	330	344	336	1109	384.6	424	81
131	5.6	-0.076	633	285	332	347	338	1125	387	426	81
132	5.4	-0.076	641	285	335	350	339	1138	390.1	429	81
133	5.3	-0.075	650	285	337	353	341	1138	393.3	431	81
134	5.1	-0.075	663	286	340	357	344	1148	397.9	431	81
135	5	-0.075	668	286	343	360	346	1148	400.6	434	80
136	4.8	-0.076	672	287	346	364	348	1143	403.4	434	80
137	4.7	-0.076	681	287	349	368	350	1170	407.1	437	81
138	4.6	-0.077	692	287	352	371	353	1202	411.1	439	81
139	4.4	-0.077	701	288	356	375	355	1216	415	442	81
140	4.3	-0.076	711	287	359	379	358	1217	418.8	443	81
141	4.1	-0.077	727	289	363	382	361	1209	424.2	444	83
142	4	-0.077	736	289	366	386	363	1208	428	447	82
143	3.9	-0.076	744	289	370	389	365	1207	431.3	449	82
144	3.8	-0.075	748	288	374	393	368	1210	434.1	450	83
145	3.6	-0.077	749	289	377	397	370	1215	436.5	450	83
146	3.5	-0.076	756	290	381	400	373	1221	440.2	451	83
147	3.4	-0.075	760	291	386	403	376	1219	443	450	83
148	3.3	-0.075	759	291	390	406	378	1213	445	451	83
149	3.2	-0.075	759	291	395	410	382	1181	447.4	449	84
150	3.1	-0.075	750	292	399	413	384	1159	447.6	447	84
151	3	-0.075	739	293	403	416	386	1184	447.4	445	84
152	2.9	-0.075	728	294	407	420	389	1166	447.7	445	81
153	2.8	-0.073	722	294	412	423	391	1117	448.5	442	83
154	2.7	-0.074	710	294	416	426	393	1081	447.8	439	83
155	2.6	-0.072	700	294	421	430	395	1040	447.9	435	81
156	2.6	-0.071	681	294	425	432	395	1011	445.5	431	83
157	2.5	-0.07	671	295	429	434	397	985	445.4	427	82

## Wood Heater Test Fuel Data - ASTM E2780

Manufacturer : MF Fire  
 Model : NovaC  
 Tracking No. : 2468  
 Project No. : 0552WS003E  
 Test Date : 7/12/2023  
 Run No. : 2

Moisture Meter Cal	
Cal Block	Measured
12.0	12.0
22.0	22.0

Firebox Volume : 1.70 ft<sup>3</sup>  
 % 2 x 4 Required : 35 - 65 %  
 Ideal Fuel Weight : 11.9 lb.  
 Minimum Fuel Weight : 10.71 lb.  
 Maximum Fuel Weight : 13.09 lb.

Fuel Piece Data										Wet Weights, lb		Dry Weights, lb	
PC #	Weight, lb	Size	Length, In	Moisture Readings, Dry Basis %			Average MC, % db	Dry Weight, lb.	Volume, ft <sup>3</sup>	4 x 4		2 x 4	
										4 x 4	2 x 4	4 x 4	2 x 4
1	1.20	2x4	14.00	20.5	19.3	21.2	20.3	1.00	0.0425		1.2		1.00
2	1.10	2x4	14.00	22.6	23.1	23.4	23.0	0.89	0.0425		1.1		0.89
3	1.20	2x4	14.00	22.7	22.8	23.1	22.9	0.98	0.0425		1.2		0.98
4	3.80	4x4	14.00	20.4	19.5	19.1	19.7	3.18	0.0992	3.8		3.18	
5	3.20	4x4	14.00	22.4	22.7	24.9	23.3	2.59	0.0992	3.2		2.59	
6													
7													
8													
9													

Spacer Data														
Moisture Readings, Dry Basis % (One reading per spacer)										Avg : 10.7				
11.2	11.0	9.4	10.6											
11.8	12.0	10.9	11.1											
8.4	8.7	11.6	11.4											
10.7	12.6	10.0	9.3											

Assembled Crib Fuel Load with Spacers Attached													
PC #	Weight, lb with Spacers	Size	4 x 4s	2 x 4s									
					1	1.60	2x4		1.6000				
2	1.60	2x4		1.6000									
3	1.60	2x4		1.6000									
4	4.00	4x4	4.00										
5	3.40	4x4	3.40										
6													
7													
8													
9													
					Combined Mass of 4 x 4s	7.4	lb						
					Combined Mass of 2 x 4s	4.8	lb						
					Total Wet Mass of Fuel Load	12.2	lb						

Fuel Load Properties										
Type	Number of Pieces	Wet Weight, lb.	Dry Weight, lb.	Fuel Loading Density, lb/ft <sup>3</sup>		Dry Fuel Density, lb/ft <sup>3</sup>	Wet Fuel Density, lb/ft <sup>3</sup>	Moisture, %		
				Wet Basis	Dry Basis			Dry Basis	Wet Basis	
2 x 4	3	3.5	2.87	7.18	5.98	26.49	32.20	19.91	16.61	
4 x 4	2	7.0	5.77							
Spacers	16	1.7	1.54							
Totals		12.2	10.17							

Compliance Checks						
	Fuel Load, Wet Lb.	Load Density, lb/ft <sup>3</sup> of FB vol	Fuel Density, lb/ft <sup>3</sup>	% of Fuel load mass which is 2x4	Fuel Load Peices Mositure, % db	
Measured	12.2	7.18	26.49	39	21.8	
Required	10.7 - 13.1	6.3 - 7.7	25 - 36	35 - 65	19 - 25	
Complies ?	Yes	Yes	Yes	Yes	Yes	









Wood Heater Test Data

Run: 2

Manufacturer: MF Fire
Model: Nova3C
Tracking No.: 2483
Project No.: 192716500E
Beginning Clock Time: 12:20

PM Control Modules: 335,338
Dilution Tunnel MM(dry): 28.00
Dilution Tunnel MM(wet): 28.73
Dilution Tunnel SDC: 2.00
Tunnel Area: 0.14835 ft2
Plot Tube Cp: 0.59

Avg. Tunnel Velocity: 17.5 in. Hg
Initial Tunnel Flow: 235.8 scfm
Avg. Heating Chamber Temp: 17.5 in. Hg
Post-Test Leak Check (1): 0.001 cfm @ 16 in. Hg
Post-Test Leak Check (2): 0.001 cfm @ 16 in. Hg
Average Test Piece Fuel Moisture: 19.91 Dry Basis %

Technician Signature:

Meter Box Y Factor: 1.007 (1) 1.015 (2) 1.012 (Amb)
Room Air Velocity: 14.5

Barometric Pressure: 30.06 Begin Middle End Average 30.03 30.05

OMNI Equipment Numbers:

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Velocity Traverse Data
PL1 PL2 PL3 PL4 PL5 PL6 PL7 PL8 Center
Initial dp 0.104 0.106 0.108 0.102 0.102 0.106 0.108 0.102 0.104
Temp: 124 124 124 123 123 123 122 122 126 F
Vavg 22.47 ft/sec Vcent 22.47 ft/sec Fp 1.000 g/wg

Main data table with columns: Elapsed Time (min), Gas Meter 1 (ft³), Gas Meter 2 (ft³), Particulate Sampling Data (Orifice dH1, Orifice dH2, Meter 1 Vacuum, Meter 2 Vacuum, Orifice Temp, Meter 1 Temp, Meter 2 Temp), Dilution Tunnel Center dp, Pro. Rate Pro. Rate 1, Pro. Rate Pro. Rate 2, Fuel Weight (lb) Scale Reading, Weight Change, Firebox Bottom, Firebox Top, Firebox Left, Firebox Right, Avg. Stove Surface Temperature (Total = At), Stack Catalyst Exit, Filter 1, Driver Exit 1, Filter 2, Driver Exit 2, Ambient, Draft (H2O), CO2 (%), CO (%).

# Wood Heater Test Data

Run: **2**

Manufacturer: MF Fire  
 Model: Nova3C  
 Tracking No.: 2483  
 Project No.: 19276500E  
 Date: 12/20  
 Beginning Clock Time: 12:20

Total Sampling Time: 140 min  
 Recording Interval: 6 min  
 Turn Down Time: 0 min  
 Background Sample Volume: 22,024 cubic feet

PM Control Modules: 335,338  
 Dilution Tunnel MM(dry): 29.00 lbf-mole  
 Dilution Tunnel MM(wet): 28.78 lbf-mole  
 Dilution Tunnel SFCO: 2.00  
 Dilution Tunnel SFCO: 2.00  
 Tunnel Area: 0.18535 ft<sup>2</sup>  
 Pilot Tube Cp: 0.59

Avg. Tunnel Velocity: 22.83 ft/sec.  
 Initial Tunnel Flow: 235.8 scfm  
 Average Chamber Flow: 235.8 scfm  
 Post-Test Fuel Leak Check (1): 0.003 cfm @ 17 in. Hg  
 Post-Test Fuel Leak Check (2): 0.003 cfm @ 16 in. Hg  
 Average Test Piece Fuel Moisture: 19.91 Dry Basis %

Technician Signature: \_\_\_\_\_

Meter Box Y Factor: 1.007 (1) 1.015 (2) 1.012 (Amb)

Barometric Pressure:  30.06  30.03  30.05  14.5

OMNI Equipment Numbers:

Velocity Traverse Data		Temperature Data (F)						
Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center
Initial dp	0.104	0.106	0.106	0.102	0.106	0.108	0.102	0.104
Temp:	124	124	124	123	123	122	122	126
V <sub>test</sub>		V <sub>amb</sub>		V <sub>amb</sub>		F <sub>p</sub>		q <sub>w</sub>
22.47		22.47		22.47		ft/sec		1.000

Elapsed Time (min)	Particulate Sampling Data										Temperature Data (F)										Stack Gas Data										
	Gas Meter 1 (ft <sup>3</sup> )	Gas Meter 2 (ft <sup>3</sup> )	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dh1 (H <sub>2</sub> O) (°F)	Meter 1 Temp (°F)	Orifice dh2 (H <sub>2</sub> O) (°F)	Meter 2 Vacuum (°Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dp	Pro. Rate Pro. Rate 2	Scale Reading	Weight Change	Fiebox Top	Fiebox Bottom	Fiebox Back	Fiebox Left	Fiebox Right	Avg. Stove Surface (Tot = At)	Stack Catalyst Exit	Stack	Filter 1	Filter 2	Driver Exit 2	Ambient	Drift (H <sub>2</sub> O) (%)	CO <sub>2</sub> (%)	CO (%)			
133	21.520	21.114	0.16	0.16	1.28	94	2.11	0.92	95	1.6	117	0.106	100	0.2	-0.1	500	304	428	411	386	406	851	366	82	61	84	52	83	-0.065	6.13	0.02
134	21.695	21.274	0.16	0.16	1.27	94	2.11	0.92	95	1.6	117	0.101	104	0.2	0	500	304	428	411	385	406	850	366	82	61	84	53	85	-0.065	6.07	0.02
135	21.849	21.433	0.16	0.16	1.28	94	2.11	0.92	95	1.6	118	0.104	101	0.0	0	499	305	428	410	385	405	848	365	82	61	84	53	84	-0.064	6.02	0.02
136	22.013	21.592	0.16	0.16	1.28	94	2.11	0.92	95	1.6	117	0.104	101	0.0	-0.1	495	305	428	410	385	405	847	365	82	61	84	52	85	-0.064	5.98	0.02
137	22.176	21.752	0.16	0.16	1.28	94	2.11	0.92	95	1.6	118	0.105	100	0.1	0	494	305	428	410	385	404	847	366	82	61	84	52	83	-0.065	5.94	0.02
138	22.340	21.912	0.16	0.16	1.28	94	2.11	0.93	95	1.6	117	0.108	99	0.1	0	491	306	428	410	385	404	846	365	82	61	85	53	85	-0.065	5.83	0.02
139	22.505	22.071	0.16	0.16	1.28	94	2.11	0.92	95	1.6	117	0.105	102	0.0	0	493	306	427	410	384	404	845	365	82	61	84	52	86	-0.064	5.8	0.02
140	22.669	22.231	0.16	0.16	1.27	94	2.11	0.92	95	1.6	117	0.103	102	0.0	-0.1	491	306	427	410	384	404	843	364	82	61	84	52	84	-0.065	5.8	0.02

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## Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire \_\_\_\_\_ Equipment Numbers: 637,283A,716  
 Model: NovaC \_\_\_\_\_  
 Tracking No.: 2468 \_\_\_\_\_  
 Project No.: 0552WS003E \_\_\_\_\_  
 Run #: 2 \_\_\_\_\_  
 Date: 7/12/23 \_\_\_\_\_

**TRAIN 1 (First Hour emissions)**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter				0.0
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:    0.0

**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	E992	121.0	118.4	2.6
C. Rear filter catch	Filter	E993	118.1	118.0	0.1
D. Probe catch*	Probe	21	114390.2	114390.2	0.0
E. Filter seals catch*	Seals	S529	3424.6	3424.3	0.3

**Sub-Total**    Total Particulate, mg:    3.0

**Train 1 Aggregate**    Total Particulate, mg:    **3.0**

**TRAIN 2**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	E994	121.3	118.7	2.6
B. Rear filter catch	Filter	E995	118.0	117.9	0.1
C. Probe catch*	Probe	61	118127.7	118127.7	0.0
D. Filter seals catch*	Seals	S530	3302.0	3301.8	0.2

**Total Particulate, mg:    2.9**

**AMBIENT**

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch*	Filter	E996	117.7	117.7	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: \_\_\_\_\_

## Run 2 First Hour Emissions Data

# Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire  
 Model: NovaC  
 Project No.: 0552WS003E  
 Tracking No.: 2468  
 Run: 2  
 Test Date: 07/12/23

Technician Signature: \_\_\_\_\_

Burn Rate  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	<b>4.61 kg/hr dry</b>  134 degrees Fahrenheit 23.19 feet/second 14329.3 dscf/hour  0.109 inches H2O 60 minutes
--	---

	AMBIENT		SAMPLE TRAIN 1		SAMPLE TRAIN 2		FIRST HOUR FILTER (TRAIN 1)	
Total Sample Volume - Vm	21.008	cubic feet	9.566	cubic feet	0.000	cubic feet	9.566	cubic feet
Average Gas Meter Temperature	83	degrees Fahrenheit	87	degrees Fahrenheit	#DIV/0!	degrees Fahrenheit	87	degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmst	20.732	dscf	9.435	dscf	#DIV/0!	dscf	9.435	dscf
Total Particulates - m <sub>p</sub>	0	mg	2.9	mg	0	mg	2.9	mg
Particulate Concentration (dry-standard) - C <sub>p</sub> /C <sub>s</sub>	0.000000	grams/dscf	0.00031	grams/dscf	#DIV/0!	grams/dscf	0.00031	grams/dscf
Total Particulate Emissions - E <sub>T</sub>	0.00	grams	4.40	grams	#DIV/0!	grams	4.40	grams
Particulate Emission Rate	0.00	grams/hour	4.40	grams/hour	#DIV/0!	grams/hour	4.40	grams/hour
Emissions Factor		grams/kg	0.95	g/kg	#DIV/0!	g/kg	1.31	g/kg
Difference from Average Total Particulate Emissions			#DIV/0!	grams				
<b>Final Average Results</b>								
<b>Complete Test Run</b>								
Total Particulate Emissions - E <sub>T</sub>	#DIV/0!	grams	Filter Temps, °F	< 90	First Hour	Train 1	Train 2	Complies?
Particulate Emission Rate	#DIV/0!	grams/hour	Filter Face Velocity, fpm	< 30	86	86	88	OK
Emissions Factor	#DIV/0!	grams/kg	Dryer Exit Temp, °F	< 80	8.78	8.78	0.00	OK
			Leakage Rate, cfm	0.01	59	59	53	OK
			< 4% of avg sample rate or		0.000	0.000	0.000	OK
			< 0.01 cfm, lesser of the two		0	0	0	OK
			Neg. Probe Weight	=> 0	0	0	0	OK
<b>First Hour Emissions</b>								
Total Particulate Emissions - E <sub>T</sub>	4.40	grams	< 90 for < 10% of θ		0.00%	0.00%	#DIV/0!	#DIV/0!
Particulate Emission Rate	4.40	grams/hour	> 110 for < 10% of θ		0.00%	0.00%	#DIV/0!	#DIV/0!
Emissions Factor	1.31	grams/kg	# Readings < 80%		0	0	0	OK
7.5% of Average Total Particulate Emissions	#DIV/0!	grams	# Readings > 120%		0	0	0	OK
			Ambient Temp, °F	< 55	82	82	82	OK
			(min / max)	> 90	85	85	85	OK
			Train Precision	(A) Within 7.5%	N/A for 1st hr	N/A for 1st hr	N/A for 1st hr	N/A
			One of A or B must	(B) Within 0.5 g/kg	N/A for 1st hr	N/A for 1st hr	N/A for 1st hr	N/A
			Stove Surface ΔT	Within 125 °F	12	12	12	OK
			Room Air Velocity	< 50 fpm	15	15	15	OK





# Wood Heater Test Data

U

Run: 2

Manufacturer: MF Fire  
 Model: Nova3C  
 Tracking No.: 2483  
 Project No.: 19276500E  
 Date: 10/25/2019  
 Beginning Clock Time: 12:20

PM Control Modules: 371,338  
 Dilution Tunnel MM(dry): 29.00 Ibb-mole  
 Dilution Tunnel MM(wet): 28.78 Ibb-mole  
 Dilution Tunnel SFCO: 2.00 SFCO  
 Dilution Tunnel SFCO: 2.00 SFCO  
 Tunnel Area: 0.18335 ft<sup>2</sup>  
 Pilot Tube Cp: 0.59

Avg. Tunnel Velocity: 25.18 ft/sec.  
 Initial Tunnel Flow: 235.8 scfm  
 Average Chamber Temp: 303.03 °F @ 17 in. Hg  
 Post-Test Leak Check (1): 0.106 ft/sec @ 17 in. Hg  
 Post-Test Leak Check (2): 0.102 ft/sec @ 17 in. Hg  
 Average Test Piece Fuel Moisture: 19.91 Dry Basis %

Technician Signature: \_\_\_\_\_

Meter Box Y Factor: 1.014 (1) 1.015 (2) 1.012 (Amb)	
Biometric Pressure:	Room Air Velocity, [ft/min]
Begin 30.06	14.5
Middle 30.03	
End 30.03	
Average 30.05	

Velocity Traverse Data									
PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8	Center	
Initial dp	0.104	0.104	0.106	0.102	0.106	0.108	0.102	0.104	H <sub>2</sub> O
Temp:	124	124	124	123	123	122	122	126	F
V <sub>ave</sub>	22.47	22.47	22.47	22.47	22.47	22.47	22.47	22.47	q <sub>wq</sub>
V <sub>cent</sub>									F <sub>p</sub>
	1.000								

OMNI Equipment Numbers:

Elapsed Time (min)	Particulate Sampling Data										Temperature Data (F)										Stack Gas Data							
	Gas Meter 1 (ft <sup>3</sup> )	Gas Meter 2 (ft <sup>3</sup> )	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dh1 (H <sub>2</sub> O)	Orifice dh2 (H <sub>2</sub> O)	Meter 1 Vacuum (Hg)	Meter 2 Vacuum (Hg)	Dilution Tunnel Center dp	Pro. Rate 1	Pro. Rate 2	Fuel Weight Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface (Tot=At)	Catalyst Exit	Stack	Filter 1	Filter 2	Driver Exit 2	Ambient	Draft (H <sub>2</sub> O)	CO <sub>2</sub> (%)	CO (%)
31	4.852	0.16	0.16	1.26	87	2.14	1.26	87	2.14	100	6.0	-0.2	800	308	420	455	411	479	1189	483	85	58	88	48	83	-0.078	9.09	0.08
32	5.014	0.16	0.16	1.26	87	2.14	1.26	87	2.14	102	6.0	0	790	309	422	456	412	478	1168	478	82	58	88	48	84	-0.078	8.98	0.06
33	5.176	0.16	0.16	1.27	87	2.14	1.27	87	2.14	101	5.8	-0.2	770	308	424	458	415	475	1154	473	79	58	86	49	83	-0.079	8.38	0.02
34	5.337	0.16	0.16	1.26	87	2.13	1.26	87	2.13	104	5.8	0	760	308	426	459	415	474	1139	469	77	58	83	49	85	-0.076	8.14	0.02
35	5.699	0.16	0.16	1.26	88	2.13	1.26	88	2.13	100	5.6	-0.2	752	308	428	460	417	473	1133	465	76	58	82	49	84	-0.076	8.09	0.02
36	5.660	0.16	0.16	1.27	88	2.12	1.27	88	2.12	103	5.4	-0.2	740	308	431	461	417	471	1128	462	75	58	82	49	85	-0.077	8.04	0.02
37	5.622	0.16	0.16	1.27	88	2.12	1.27	88	2.12	99	5.4	0	736	308	433	462	418	471	1124	458	75	58	81	49	83	-0.076	7.94	0.02
38	5.894	0.16	0.16	1.26	88	2.12	1.26	88	2.12	99	5.3	-0.1	720	308	435	462	419	469	1123	456	75	58	81	50	84	-0.076	7.88	0.02
39	6.147	0.16	0.16	1.28	88	2.12	1.28	88	2.12	104	5.1	-0.2	713	307	436	464	419	468	1122	454	75	58	81	50	85	-0.075	7.92	0.02
40	6.309	0.16	0.16	1.27	88	2.11	1.27	88	2.11	99	5.0	-0.1	707	307	438	464	419	467	1116	452	75	58	81	50	85	-0.076	7.75	0.05
41	6.871	0.16	0.16	1.27	88	2.11	1.27	88	2.11	101	4.8	-0.1	702	307	439	465	419	466	1109	449	75	58	81	50	84	-0.076	7.76	0.05
42	6.634	0.16	0.16	1.27	89	2.12	1.27	89	2.12	100	4.8	-0.1	697	306	440	464	419	465	1104	447	75	58	81	50	84	-0.075	7.68	0.06
43	6.796	0.16	0.16	1.27	89	2.11	1.27	89	2.11	100	4.8	0	691	305	441	466	419	464	1104	445	75	58	81	51	83	-0.075	7.72	0.05
44	6.559	0.16	0.16	1.27	89	2.11	1.27	89	2.11	100	4.6	-0.2	689	306	442	468	418	464	1104	443	75	58	81	51	84	-0.075	7.7	0.06
45	7.121	0.16	0.16	1.28	89	2.11	1.28	89	2.11	101	4.6	0	684	306	443	466	417	463	1107	442	76	58	82	51	85	-0.075	7.86	0.06
46	7.584	0.16	0.16	1.28	89	2.11	1.28	89	2.11	101	4.5	-0.1	682	305	444	466	417	463	1113	441	76	58	82	51	83	-0.075	7.9	0.09
47	7.447	0.16	0.16	1.28	89	2.11	1.28	89	2.11	100	4.4	-0.1	681	304	445	466	417	463	1119	440	76	58	82	51	84	-0.074	7.84	0.12
48	7.610	0.16	0.16	1.27	90	2.1	1.27	90	2.1	101	4.3	-0.1	680	304	445	466	415	462	1124	439	76	58	82	51	84	-0.074	7.88	0.11
49	7.773	0.16	0.16	1.28	90	2.11	1.28	90	2.11	103	4.2	-0.1	679	303	445	467	415	462	1129	438	77	58	82	51	84	-0.075	8.06	0.13
50	7.937	0.16	0.16	1.28	90	2.11	1.28	90	2.11	103	4.1	-0.1	682	303	446	467	415	463	1136	438	77	58	82	52	84	-0.074	8.17	0.17
51	8.099	0.16	0.16	1.28	90	2.11	1.28	90	2.11	99	3.9	-0.2	685	302	447	467	414	463	1146	437	77	59	83	52	84	-0.074	8.2	0.13
52	8.562	0.16	0.16	1.27	90	2.11	1.27	90	2.11	102	3.9	0	684	302	447	468	414	463	1154	437	77	59	83	52	83	-0.074	8.25	0.1
53	8.425	0.16	0.16	1.27	90	2.11	1.27	90	2.11	102	3.7	-0.2	686	302	448	468	413	463	1156	438	77	59	83	52	82	-0.075	8.25	0.13
54	8.887	0.16	0.16	1.28	90	2.11	1.28	90	2.11	102	3.7	0	690	300	448	469	413	464	1150	437	78	59	83	52	84	-0.075	8.03	0.05
55	8.750	0.16	0.16	1.27	90	2.11	1.27	90	2.11	101	3.6	-0.1	689	300	448	469	413	464	1136	437	78	59	83	52	84	-0.074	7.57	0.01
56	8.913	0.16	0.16	1.27	90	2.11	1.27	90	2.11	100	3.5	-0.1	689	300	449	468	413	464	1111	434	78	59	83	52	83	-0.073	7.16	0.01
57	9.076	0.16	0.16	1.28	90	2.11	1.28	90	2.11	102	3.5	0	683	299	449	469	411	462	1085	432	78	59	83	52	84	-0.073	6.85	0
58	9.239	0.16	0.16	1.28	90	2.11	1.28	90	2.11	100	3.4	-0.1	676	298	449	469	412	461	1051	428	78	58	84	53	84	-0.072	6.04	0
59	9.402	0.16	0.16	1.28	91	2.11	1.28	91	2.11	102	3.3	-0.1	667	297	449	469	411	459	1023	425	79	59	84	53	84	-0.073	5.8	0
60	9.566	0.16	0.16	1.28	91	2.11	1.28	91	2.11	105	3.3	0	651	298	450	468	411	456	1009	422	79	58	84	53	85	-0.072	5.72	0.01

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## Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire \_\_\_\_\_ Equipment Numbers: \_\_\_\_\_  
 Model: NovaC \_\_\_\_\_  
 Tracking No.: 2468 \_\_\_\_\_  
 Project No.: 0552WS003E \_\_\_\_\_  
 Run #: 2 \_\_\_\_\_  
 Date: 7/12/23 \_\_\_\_\_

**TRAIN 1 (First Hour emissions)**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	E990	121.1	118.2	2.9
C. Rear filter catch	Filter	E991	117.9	117.9	0.0
D. Probe catch*	Probe	73	117070.5	117070.5	0.0
E. Filter seals catch*	Seals	S528	3407.0	3407.0	0.0

**Sub-Total**    Total Particulate, mg:    2.9

**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				0.0
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:    0.0

**Train 1 Aggregate**    Total Particulate, mg:    **2.9**

**TRAIN 2**

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

Total Particulate, mg:    **0.0**

**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: \_\_\_\_\_

# OMNI-Test Laboratories

**Manufacturer:** MF Fire  
**Model:** Nova C  
**Date:** 07/12/23  
**Run:** 2  
**Control #:**  
**Test Duration:** 140  
**Output Category:** SBR

**Technicians:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## Test Results in Accordance with CSA B415.1-10

	HHV Basis	LHV Basis
<b>Overall Efficiency</b>	71.8%	77.6%
<b>Combustion Efficiency</b>	98.3%	98.3%
<b>Heat Transfer Efficiency</b>	73%	79.0%

<b>Output Rate (kJ/h)</b>	28,140	26,694	<b>(Btu/h)</b>
<b>Burn Rate (kg/h)</b>	1.98	4.36	<b>(lb/h)</b>
<b>Input (kJ/h)</b>	39,190	37,175	<b>(Btu/h)</b>

<b>Test Load Weight (dry kg)</b>	4.62	10.17	<b>dry lb</b>
<b>MC wet (%)</b>	16.61		
<b>MC dry (%)</b>	19.92		
<b>Particulate (g)</b>	4.5		
<b>CO (g)</b>	134		
<b>Test Duration (h)</b>	2.33		

<b>Emissions</b>	<b>Particulate</b>	<b>CO</b>
<b>g/MJ Output</b>	0.07	2.04
<b>g/kg Dry Fuel</b>	0.97	28.99
<b>g/h</b>	1.93	57.35
<b>lb/MM Btu Output</b>	0.16	4.74

<b>Air/Fuel Ratio (A/F)</b>	13.90
-----------------------------	-------

VERSION:

2.4

4/15/2010

VERSION: 2.4 4/15/2010

Manufacturer: MF Fire  
 Model: Nova C  
 Date: 7/12/2023  
 Run: 2  
 Control #:   
 Test Duration: 140  
 Output Category: SBR

Appliance Type: Cat (Cat, Non-Cat, Pellet)

Temp. Units F (F or C)  
 Weight Units lb (kg or lb)

**Default Fuel Values**

	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

Wood Moisture (% wet): 16.61  
 Load Weight (lb wet): 12.20  
 Burn Rate (dry kg/h): 1.98  
 Total Particulate Emissions: 4.5 g

**Fuel Data**

	D. Fir	
HHV	19,810	kJ/kg
%C	48.73	
%H	6.87	
%O	43.9	
%Ash	0.5	

Note 1: For other fuels, use the heating value and fuel composition determined by analysis of fuel sample in accordance with Clause 9.2.

Averages 0.15 7.74 #DIV/0! 414.30 84.15

Elapsed Time (min)	Fuel Weight Remaining (lb)	Flue Gas Composition (%)			Temp. (°F)	
		CO	CO <sub>2</sub>	O <sub>2</sub>	Flue Gas	Room Temp
0	12.20	0.12	2.97		478.0	84.0
1	11.80	0.12	2.91		436.0	83.0
2	11.70	0.02	4.61		424.0	83.0
3	11.60	0.05	9.08		423.0	82.0
4	11.40	0.03	11.25		430.0	83.0
5	11.30	0.21	11.29		435.0	82.0
6	11.10	0.79	12.80		445.0	83.0
7	10.90	0.84	12.86		452.0	83.0
8	10.70	0.65	12.70		459.0	83.0
9	10.50	0.61	12.81		464.0	83.0
10	10.30	0.69	12.94		467.0	82.0
11	10.10	0.65	12.86		472.0	83.0
12	9.90	0.64	13.15		474.0	83.0
13	9.60	0.79	13.01		476.0	83.0
14	9.40	0.71	12.98		479.0	83.0
15	9.20	0.69	13.05		481.0	82.0
16	9.00	0.64	13.01		483.0	83.0
17	8.80	0.66	13.18		484.0	83.0
18	8.60	0.65	13.20		485.0	84.0
19	8.40	0.61	13.10		487.0	83.0
20	8.10	0.66	13.20		488.0	82.0
21	8.00	0.66	13.27		488.0	82.0
22	7.70	0.68	13.21		490.0	84.0
23	7.50	0.78	13.29		491.0	83.0
24	7.40	0.86	13.31		491.0	84.0
25	7.20	1.00	13.42		491.0	85.0
26	7.00	1.08	13.28		492.0	84.0
27	6.80	1.11	13.24		493.0	84.0
28	6.60	1.05	13.16		493.0	84.0
29	6.50	0.36	11.18		491.0	83.0
30	6.20	0.18	9.95		487.0	83.0
31	6.00	0.08	9.09		483.0	83.0
32	6.00	0.06	8.58		478.0	84.0
33	5.80	0.02	8.38		473.0	83.0
34	5.80	0.02	8.14		469.0	85.0
35	5.60	0.02	8.09		465.0	84.0
36	5.40	0.02	8.04		462.0	85.0
37	5.40	0.02	7.94		458.0	83.0
38	5.30	0.02	7.88		456.0	84.0
39	5.10	0.02	7.92		454.0	85.0
40	5.00	0.05	7.75		452.0	85.0
41	4.90	0.05	7.76		449.0	84.0
42	4.80	0.06	7.68		447.0	84.0
43	4.80	0.05	7.72		445.0	83.0
44	4.60	0.06	7.70		443.0	84.0
45	4.60	0.06	7.86		442.0	85.0
46	4.50	0.09	7.90		441.0	83.0
47	4.40	0.12	7.94		440.0	84.0
48	4.30	0.11	7.98		439.0	84.0
49	4.20	0.13	8.06		438	84
50	4.10	0.17	8.17		438	84
51	3.90	0.13	8.2		437	84
52	3.90	0.1	8.25		437	83
53	3.70	0.13	8.25		438	82
54	3.70	0.05	8.03		437	84

Note 2: In cases where the "Fuel Weight Remaining" is the same for three or more readings in a row, a "divide by zero error" will occur in the calculation sheet. In such cases, adjust the weight values by interpolation between the first occurrence and the next reading showing a decrease in weight.

55	3.60	0.01	7.57	437	84
56	3.50	0.01	7.16	434	83
57	3.50	0	6.65	432	84
58	3.40	0	6.04	428	84
59	3.30	0	5.8	425	84
60	3.30	0.01	5.72	422	85
61	3.20	0.01	5.65	420	82
62	3.10	0.01	5.57	417	83
63	3.10	0.01	5.56	415	84
64	3.00	0.01	5.51	413	82
65	3.00	0.01	5.48	410	84
66	2.90	0.01	5.48	408	83
67	2.80	0.01	5.44	407	82
68	2.80	0.01	5.42	404	82
69	2.70	0.02	5.44	402	85
70	2.70	0.02	5.46	401	85
71	2.70	0.02	5.57	399	84
72	2.60	0.02	5.57	399	85
73	2.60	0.01	5.73	396	85
74	2.50	0.01	5.89	395	84
75	2.40	0.01	6.02	393	85
76	2.40	0.01	6.01	392	85
77	2.40	0.01	6.05	390	85
78	2.30	0.01	6.15	389	84
79	2.20	0.01	6.09	387	85
80	2.20	0.01	6.22	386	86
81	2.10	0.01	6.36	385	85
82	2.00	0.01	6.38	385	82
83	2.00	0.01	6.4	385	85
84	1.90	0.01	6.4	385	84
85	1.90	0.01	6.35	385	84
86	1.80	0.01	6.34	383	85
87	1.80	0.01	6.4	383	85
88	1.70	0.01	6.48	383	84
89	1.70	0.01	6.5	383	86
90	1.60	0.01	6.38	382	85
91	1.60	0.01	6.31	381	86
92	1.50	0.01	6.29	381	86
93	1.50	0.01	6.66	381	85
94	1.50	0.01	6.66	380	85
95	1.40	0.01	6.47	378	84
96	1.40	0.01	6.54	378	85
97	1.40	0.01	6.5	377	84
98	1.30	0.01	6.44	377	85
99	1.30	0.01	6.39	376	86
100	1.30	0.01	6.3	375	86
101	1.20	0.01	6.18	375	87
102	1.20	0.02	6.07	375	85
103	1.10	0.02	6.08	374	86
104	1.10	0.02	6.02	374	84
105	1.10	0.02	5.99	373	85
106	1.10	0.02	6.16	372	85
107	1.10	0.01	6.5	372	85
108	1.00	0.01	6.55	371	85
109	0.90	0.01	6.55	370	86
110	0.90	0.01	6.54	370	85
111	0.90	0.01	6.59	370	83
112	0.80	0.01	6.57	369	84
113	0.90	0.01	6.54	368	85
114	0.80	0.01	6.59	369	86
115	0.70	0.01	6.59	369	84
116	0.70	0.02	6.57	368	85
117	0.70	0.02	6.55	369	84
118	0.60	0.02	6.52	369	83
119	0.60	0.02	6.52	368	83
120	0.60	0.02	6.49	368	85
121	0.60	0.02	6.48	367	84
122	0.50	0.02	6.5	368	86
123	0.50	0.02	6.48	367	85
124	0.50	0.02	6.52	368	83
125	0.40	0.02	6.48	368	87
126	0.40	0.02	6.48	368	87
127	0.40	0.02	6.39	367	85
128	0.40	0.02	6.34	367	86

129	0.30	0.02	6.33		367	85
130	0.30	0.02	6.32		367	85
131	0.30	0.02	6.16		367	86
132	0.30	0.02	6.13		366	86
133	0.20	0.02	6.13		366	83
134	0.20	0.02	6.07		366	85
135	0.20	0.02	6.02		365	84
136	0.10	0.02	5.98		365	85
137	0.10	0.02	5.84		366	83
138	0.10	0.02	5.83		365	85
139	0.10	0.02	5.8		365	86
140	0.00	0.02	5.8		364	84

### ASTM E2780 Wood Heater Run Sheets

Client: MF Fire \_\_\_\_\_ Project Number: 0552WS003E \_\_\_\_\_ Run Number: 2 \_\_\_\_\_  
 Model: Nova C \_\_\_\_\_ Tracking Number: 2467 \_\_\_\_\_ Date: 7/12/2023 \_\_\_\_\_  
 Test Crew: RT \_\_\_\_\_  
 OMNI Equipment ID numbers: \_\_\_\_\_

#### Wood Heater Run Notes

##### Air Control Settings

Primary:

FIXED  
(SINGLE BURN-RATE UNIT)

Secondary: N/A

Tertiary/Pilot: N/A

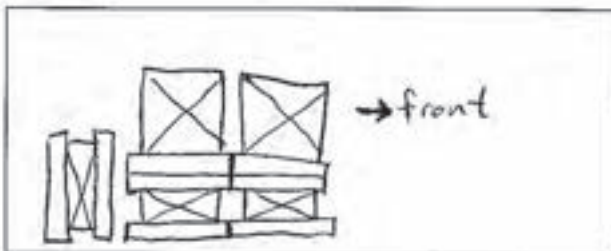
Fan: N/A

##### Preburn Notes

Time	Notes
0942	Loaded PB
45	ADJUST / STIR
88min	New load added to Preburn at 1.6/lbs 94/lbs
	Preburn moisture 23.8, 22.7, 24.0
12:19 157	At 2.5/lbs pre burn stopped

##### Test Notes

Sketch test fuel configuration:



Start up procedures & Timeline:

Bypass: Used  
 Fuel loaded by: 40  
 Door closed at: 45  
 Primary air: N/A

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Time	Notes
1220	Test start
1320	First hour stopped
1440	Test complete

Technician Signature: Blo K. Meyer

Date: 9-27-23



**ASTM E2780 Wood Heater Run Sheets**

Client: MF Fire \_\_\_\_\_ Project Number: 0552WS003E \_\_\_\_\_ Run Number: 2 \_\_\_\_\_

Model: Nova C \_\_\_\_\_ Tracking Number: 2467 \_\_\_\_\_ Date: 7/12/2023 \_\_\_\_\_

Test Crew: RT \_\_\_\_\_

OMNI Equipment ID numbers: \_\_\_\_\_

**Wood Heater Supplemental Data**

Start Time: \_\_\_\_\_

Booth #: \_\_\_\_\_

Stop Time: \_\_\_\_\_

**Stack Gas Leak Check:**

Initial: NITROGEN Final:

**Sample Train Leak Check:**

A: 0.001 @ 16" Hg  
B: 0.001 @ 16" Hg

*1st hour 0.000 @ 17 inch mercury*

Calibrations: Span Gas CO<sub>2</sub> 16.84 CO 4.38 CO ppm... 500

*Bias check w/ Nitrogen*

	Pre Test		Post Test	
	Zero	Span	Zero	Span
Time	<u>1005</u>	<u>1008</u>	<u>1444</u>	<u>1448</u>
CO <sub>2</sub>	<u>0.00</u>	<u>16.84</u>	<u>0.00</u>	<u>16.79</u>
CO	<u>0.00</u>	<u>4.38</u>	<u>0.000</u>	<u>4.36</u>
	<u>0</u>	<u>500</u>	<u>-7</u>	<u>480</u>

Air Velocity (ft/min): Initial: 14 Final: 15

Scale Audit (lbs): Initial: 10.0 Final: 10.0

Pitot Tube Leak Test: Initial:  Final:

Stack Diameter (in): 6

Induced Draft: N/A

% Smoke Capture: 100

Flue Pipe Cleaned Prior to First Test in Series:

Date: 7/10/2023 Initials: RT

	Initial	Middle	Ending
P <sub>b</sub> (in/Hg)	<u>30.06</u>	<input checked="" type="checkbox"/>	<u>30.03</u>
RH (%)	<u>46</u>	<input checked="" type="checkbox"/>	<u>40</u>
Ambient (°F)	<u>83</u>	<input checked="" type="checkbox"/>	<u>85</u>

Tunnel Traverse			
	Microtector Reading	dP (in H <sub>2</sub> O)	T (°F)
1	<u>.052</u>	<u>.104</u>	<u>124</u>
2	<u>.053</u>	<u>.106</u>	<u>124</u>
3	<u>.053</u>	<u>.106</u>	<u>124</u>
4	<u>.051</u>	<u>.02</u>	<u>123</u>
5	<u>.052</u>	<u>.102</u>	<u>123</u>
6	<u>.053</u>	<u>.106</u>	<u>123</u>
7	<u>.054</u>	<u>.108</u>	<u>122</u>
8	<u>.051</u>	<u>.102</u>	<u>122</u>
Center:			
	<u>.052</u>	<u>0.104</u>	<u>126</u>

Tunnel Static Pressure (in H <sub>2</sub> O):	
Beginning of Test	End of Test
<u>-.1</u>	<u>-.1</u>

Background Filter Volume: \_\_\_\_\_

Technician Signature: 

Date: 07-12-2023

### ASTM E2780 Wood Heater Run Sheets

Client: MF Fire \_\_\_\_\_ Project Number: 0552WS003E \_\_\_\_\_ Run Number: 2 \_\_\_\_\_  
 Model: Nova C \_\_\_\_\_ Tracking Number: 2467 \_\_\_\_\_ Date: 7/12/2023 \_\_\_\_\_  
 Test Crew: RT \_\_\_\_\_  
 OMNI Equipment ID numbers: \_\_\_\_\_

#### Wood Heater Fuel Data

Fuel: Douglas fir, untreated and air dried, standard grade or better dimensional lumber

Pre-Burn Fuel					
<b>Calibration:</b>		Cal Value (1) = 12%	Actual Reading	<u>12.0</u>	
		Cal Value (2) = 22%	Actual Reading	<u>22.0</u>	
<b>Piece:</b>	<b>Length:</b>	<b>Reading:</b>	<b>Piece:</b>	<b>Length:</b>	<b>Reading:</b>
1	<u>14</u> in	<u>22.5</u>	7	<u>10</u> in	<u>21.7</u>
2	<u>14</u> in	<u>23.1</u>	8	<u>10</u> in	<u>21.9</u>
3	<u>14</u> in	<u>20.0</u>	9	_____ in	_____
4	<u>14</u> in	<u>21.0</u>	10	_____ in	_____
5	<u>6</u> in	<u>22.1</u>	11	_____ in	_____
6	<u>10</u> in	<u>22.6</u>	12	_____ in	_____
Total Pre-Burn Fuel Weight: <u>7.5</u>		Pre-Burn Fuel Average Moisture: _____			
Time (clock): <u>0922</u>		Room Temperature (F): <u>72.0</u>		Initials: <u>RT</u>	

Test Fuel					
Firebox Volume (ft³): <u>1.70</u>		Test Fuel Piece Length (in): <u>14</u>			
Load Weight Range (lb): <u>10.8 - 13.0</u>		Total Wet Fuel Load Weight (lb): <u>12.2</u>			
Fuel Type & Amount: 2 x 4: _____		4 x 4: <u>2</u>			
Weight (with spacers): <u>4.7</u>		Weight (with spacers): <u>7.4</u>			
<b>Piece:</b>	<b>Weight (lbs):</b>	<b>Moisture Readings (%DB):</b>		<b>Fuel Type:</b>	
1	<u>1.6/1.2</u>	<u>20.5</u>	<u>19.3</u>	<u>21.2</u>	<u>2x4</u>
2	<u>1.5/1.1</u>	<u>22.6</u>	<u>23.1</u>	<u>23.4</u>	<u>2x4</u>
3	<u>1.6/1.2</u>	<u>22.7</u>	<u>27.8</u>	<u>23.1</u>	<u>2x4</u>
4	<u>4.8/3.8</u>	<u>20.4</u>	<u>19.5</u>	<u>19.1</u>	<u>4x4</u>
5	<u>3.4/3.2</u>	<u>22.4</u>	<u>22.7</u>	<u>24.9</u>	<u>4x4</u>
6	_____	_____	_____	_____	_____
7	_____	_____	_____	_____	_____
<b>Spacer Moisture Readings (%DB)</b>					
<u>11.2</u>	<u>11.0</u>	<u>9.4</u>	<u>10.6</u>	_____	_____
<u>11.8</u>	<u>12.0</u>	<u>10.9</u>	<u>11.1</u>	_____	_____
<u>8.4</u>	<u>8.7</u>	<u>11.6</u>	<u>11.4</u>	_____	_____
<u>10.7</u>	<u>12.6</u>	<u>10.0</u>	<u>9.3</u>	_____	_____
Time (clock): <u>1000</u>		Room Temperature (F): <u>78.0</u>		Initials: <u>RT</u>	

Technician Signature: [Signature] Date: 7-12-2023

**ASTM E2780 Wood Heater Run Sheets**

Client: MF Fire \_\_\_\_\_ Project Number: 0552WS003E \_\_\_\_\_ Run Number: 2 \_\_\_\_\_  
 Model: Nova C \_\_\_\_\_ Tracking Number: 2467 \_\_\_\_\_ Date: 7/12/2023 \_\_\_\_\_  
 Test Crew: RT \_\_\_\_\_  
 OMNI Equipment ID numbers: \_\_\_\_\_

**ASTM E2515 Lab Sheet**

Assembled By:

RT legs

Date/Time in Dessicator:

07-12-2023

Weighing #1	Weighing #2	Weighing #3	Weighing #4	Weighing #5
Date/Time: 7-12-2023	Date/Time: 7-13-2023	Date/Time: 7-17-2023	Date/Time: 7-19-2023	Date/Time: 7-24-23
R/H %: 23	R/H %: 17.1	R/H %: 16.4	R/H %: 17.1	R/H %: 16.7
Temp: 78.2	Temp: 76.4	Temp: 77.5	Temp: 77.8	Temp: 78.0
200 mg Audit: 200.1	200 mg Audit: 200.1	200 mg Audit: 200.1	200 mg Audit: 200.1	200 mg Audit: 199.9
2 g Audit: 2000.2	2 g Audit: 2000.3	2 g Audit: 2000.5	2 g Audit: 2000.3	2 g Audit: 2000.1
100 g Audit: 99997.9	100 g Audit: 99997.9	100 g Audit: 99997.9	100 g Audit: 99997.8	100 g Audit: 99997.8
Initials: RT	Initials: RT	Initials: RT	Initials: RT	Initials: RT

7-27-23  
2.9  
77.3  
200.1  
2000.2  
99997.8  
RT

Train	Element	ID #	Tare (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)
A (First Hour)	Front Filter	E990	118.2 ✓	121.6	121.3	121.1 ✓		
	Rear Filter	E991	117.9 ✓	117.9	117.9 ✓			
	Probe	73	117070.5 ✓	117071.0	117070.5 ✓			
	O-Ring Set	5528	3407.0 ✓	3409.5	3408.0	3402.7	3407.1	3407.0 ✓
A (Remainder)	Front Filter	E992	118.4 ✓	121.2	121.0 ✓			
	Rear Filter	E993	118.0 ✓	118.1	118.1 ✓			
	Probe	21	114390.2 ✓	114390.4	114390.2 ✓			
	O-Ring Set	5529	3424.3 ✓	3427.5	3426.3	3425.9	3425.1	3424.7
B	Front Filter	E994	118.7 ✓	121.4	121.3 121.1 ✓			
	Rear Filter	E995	117.9 ✓	118.1	118.0 ✓			
	Probe	61	118127.7 ✓	118128.1	118127.7	118127.7 ✓		
	O-Ring Set	5530	3301.8 ✓	3305.3	3404.2	3303.7	3303.1	3302.6
BG	Filter	E996	117.7 ✓	117.7	117.7 ✓			

Technician Signature: B/O K. Moore

Date: 7-27-23

## Run 3 Test Data

# Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire  
 Model: Nova C  
 Project No.: 0552WS003E  
 Tracking No.: 2468  
 Run: 3  
 Test Date: 7.12.2023

Technician Signature: \_\_\_\_\_

Burn Rate	<b>1.91 kg/hr dry</b>
Average Tunnel Temperature	132 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	23.06 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	14283.8 dscf/hour
Average Delta p	0.110 inches H2O
Total Time of Test	151 minutes

	AMBIENT		SAMPLE TRAIN 1		SAMPLE TRAIN 2		FIRST HOUR FILTER (TRAIN 1)	
	Value	Requirement	Value	Requirement	Value	Requirement	Value	Requirement
Total Sample Volume - Vm	24.184 cubic feet	< 90	24.367 cubic feet	< 90	24.359 cubic feet	< 90	9.692 cubic feet	< 90
Average Gas Meter Temperature	87 degrees Fahrenheit	< 30	97 degrees Fahrenheit	< 30	98 degrees Fahrenheit	< 30	94 degrees Fahrenheit	< 30
Total Sample Volume (Standard Conditions) - Vmst	23.668 dscf	< 80	23.378 dscf	< 80	23.486 dscf	< 80	9.349 dscf	< 80
Total Particulates - m <sub>p</sub>	0.2 mg	0.01	4.1 mg	0.01	4.2 mg	0.01	0 mg	0.01
Particulate Concentration (dry-standard) - C <sub>p</sub> /C <sub>s</sub>	0.000008 grams/dscf	=> 0	0.00018 grams/dscf	=> 0	0.00018 grams/dscf	=> 0	0.00000 grams/dscf	=> 0
Total Particulate Emissions - E <sub>T</sub>	0.30 grams	< 90 for < 10% of θ	6.00 grams	< 90 for < 10% of θ	6.12 grams	< 90 for < 10% of θ	0.00 grams	< 90 for < 10% of θ
Particulate Emission Rate	0.12 grams/hour	> 110 for < 10% of θ	2.38 grams/hour	> 110 for < 10% of θ	2.43 grams/hour	> 110 for < 10% of θ	0.00 grams/hour	> 110 for < 10% of θ
Emissions Factor		# Readings > 80%	1.25 g/kg	# Readings > 80%	1.28 g/kg	# Readings > 80%	0.00 g/kg	# Readings > 80%
Difference from Average Total Particulate Emissions		# Readings > 120%	0.06 grams	# Readings > 120%	0.06 grams	# Readings > 120%	0.00 grams	# Readings > 120%
<b>Final Average Results</b>		Ambient Temp, °F (min / max)		Ambient Temp, °F (min / max)		Ambient Temp, °F (min / max)		Ambient Temp, °F (min / max)
<b>Complete Test Run</b>		Train Precision		Train Precision		Train Precision		Train Precision
Total Particulate Emissions - E <sub>T</sub>	6.06 grams	One of A or B must		One of A or B must		One of A or B must		One of A or B must
Particulate Emission Rate	<b>2.41 grams/hour</b>	Stove Surface ΔT		Stove Surface ΔT		Stove Surface ΔT		Stove Surface ΔT
Emissions Factor	1.26 grams/kg	Room Air Velocity		Room Air Velocity		Room Air Velocity		Room Air Velocity
<b>First Hour Emissions</b>								
Total Particulate Emissions - E <sub>T</sub>	0.00 grams							
Particulate Emission Rate	0.00 grams/hour							
Emissions Factor	0.00 grams/kg							
7.5% of Average Total Particulate Emissions	0.45 grams							
Quality Checks								
Filter Temps, °F								
Filter Face Velocity, fpm								
Dryer Exit Temp, °F								
Leakage Rate, cfm								
< 4% of avg sample rate or < 0.01 cfm, lesser of the two								
Neg. Probe Weight								
Pro-Rate Variation								
Measured / Observed								
Train 1								
Train 2								
Complies?								

## Wood Heater Test Fuel Data - ASTM E2780

Manufacturer : MF Fire  
 Model : Nova C  
 Tracking No. : 2468  
 Project No. : 0552WS003E  
 Test Date : 7.12.2023  
 Run No. : 3

Moisture Meter Cal	
Cal Block	Measured
12.0	12.0
22.0	22.0

Firebox Volume : 1.70 ft<sup>3</sup>  
 % 2 x 4 Required : 35 - 65 %  
 Ideal Fuel Weight : 11.9 lb.  
 Minimum Fuel Weight : 10.71 lb.  
 Maximum Fuel Weight : 13.09 lb.

Fuel Piece Data										Wet Weights, lb		Dry Weights, lb	
PC #	Weight, lb	Size	Length, In	Moisture Readings, Dry Basis %			Average MC, % db	Dry Weight, lb.	Volume, ft <sup>3</sup>	4 x 4	2 x 4	4 x 4	2 x 4
1	1.40	2x4	14.00	20.1	18.5	20.4	19.7	1.17	0.0425		1.4		1.17
2	1.30	2x4	14.00	22.0	23.0	22.3	22.4	1.06	0.0425		1.3		1.06
3	1.40	2x4	14.00	23.9	24.1	24.3	24.1	1.13	0.0425		1.4		1.13
4	3.90	4x4	14.00	20.3	20.3	20.6	20.4	3.24	0.0992	3.9		3.24	
5	3.30	4x4	14.00	24.3	23.6	22.8	23.6	2.67	0.0992	3.3		2.67	
6													
7													
8													
9													

Spacer Data															
Moisture Readings, Dry Basis % (One reading per spacer)										Avg : 14.9					
10.3	17.3	9.1	19.0												
10.2	20.2	10.3	20.8												
10.3	20.8	9.3	22.0												
10.6	20.9	10.0	17.3												

Assembled Crib Fuel Load with Spacers Attached													
PC #	Weight, lb with Spacers	Size	4 x 4s	2 x 4s									
					1	1.70	2x4		1.7000				
2	1.70	2x4		1.7000									
3	1.80	2x4		1.8000									
4	4.10	4x4	4.10										
5	3.50	4x4	3.50										
6													
7													
8													
9													
					Combined Mass of 4 x 4s	7.6	lb						
					Combined Mass of 2 x 4s	5.2	lb						
					Total Wet Mass of Fuel Load	12.8	lb						

Fuel Load Properties										
Type	Number of Pieces	Wet Weight, lb.	Dry Weight, lb.	Fuel Loading Density, lb/ft <sup>3</sup>		Dry Fuel Density, lb/ft <sup>3</sup>	Wet Fuel Density, lb/ft <sup>3</sup>	Moisture, %		
				Wet Basis	Dry Basis			Dry Basis	Wet Basis	
2 x 4	3	4.1	3.36	7.53	6.22	28.43	34.65	21.04	17.38	
4 x 4	2	7.2	5.91							
Spacers	16	1.5	1.31							
Totals		12.8	10.58							

Compliance Checks						
	Fuel Load, Wet Lb.	Load Density, lb/ft <sup>3</sup> of FB vol	Fuel Density, lb/ft <sup>3</sup>	% of Fuel load mass which is 2x4	Fuel Load Peices Mositure, % db	
Measured	12.8	7.53	28.43	41	22.0	
Required	10.7 - 13.1	6.3 - 7.7	25 - 36	35 - 65	19 - 25	
Complies ?	Yes	Yes	Yes	Yes	Yes	

## Wood Heater Preburn Data - ASTM E2780

**Run: 3**

Technician Signature \_\_\_\_\_

Manufacturer: MF Fire  
 Model: Nova C  
 Tracking No.: 2468  
 Project No.: 0552WS003E  
 Test Date: 7.12.2023

Beginning Clock Time: \_\_\_\_\_

Preburn Fuel Data					
_____	1	pieces @	_____	144	inches
_____	_____	pieces @	_____	_____	inches
_____	_____	pieces @	_____	_____	inches
Fuel Moisture Readings (% DB):					
			22.8		
			23.4		
			23.7		
Avg Preburn Moisture (% DB): <b>23.30</b>					

Coal Bed	<b>2.6</b>	<b>3.2</b>
Range (lb):	(min)	(max)

Elapsed Time (min)	Scale (lb)	Stack Draft (in H <sub>2</sub> O)	Temperatures (°F)								
			FB Top	FB Bottom	FB Back	FB Left	FB Right	Cat Exit	Avg. FB	Stack	Ambient
0	11.7	-0.071	566	243	395	382	327	854	382.5	449	85
1	11.8	-0.064	559	245	399	386	331	958	383.8	424	86
2	11.6	-0.064	552	247	400	389	333	937	384.3	414	86
3	11.4	-0.065	558	249	400	392	336	1010	386.9	413	85
4	11.3	-0.066	565	251	398	394	339	1004	389.1	416	84
5	11.1	-0.065	573	252	395	395	340	1017	391.1	418	84
6	11	-0.065	577	254	392	396	343	1008	392.4	420	85
7	10.9	-0.065	579	256	389	396	344	986	392.8	418	83
8	10.8	-0.066	585	257	385	396	346	996	393.7	419	84
9	10.6	-0.065	592	259	382	395	347	1002	395.1	421	84
10	10.5	-0.066	593	260	379	395	347	997	394.8	421	85
11	10.4	-0.066	597	261	376	395	349	1005	395.6	424	85
12	10	-0.066	598	263	373	394	349	1011	395.4	434	85
13	9.8	-0.065	602	264	370	394	349	1016	395.9	438	85
14	9.8	-0.066	607	265	368	394	351	1034	396.7	437	86
15	9.7	-0.067	608	267	365	393	350	1023	396.6	428	86
16	9.6	-0.067	611	268	363	393	352	1063	397.4	428	86
17	9.4	-0.067	612	269	361	393	352	1053	397.4	428	86
18	9.2	-0.067	617	270	359	393	352	1078	398.2	429	86
19	9	-0.065	622	270	358	393	352	1030	399	430	86
20	8.8	-0.067	626	271	357	392	353	1109	399.7	432	86
21	8.7	-0.068	640	271	356	391	353	1244	402.3	436	86
22	8.5	-0.067	649	272	355	391	354	1185	404.1	438	86
23	8.3	-0.067	660	273	355	390	355	1191	406.6	442	86
24	8.2	-0.067	669	273	355	390	355	1180	408.3	444	86
25	8	-0.068	675	274	354	390	356	1175	410	444	86
26	7.9	-0.067	680	275	354	389	358	1211	411.1	445	86
27	7.8	-0.068	686	276	354	389	359	1161	412.9	446	86
28	7.6	-0.067	688	277	355	389	360	1151	413.8	447	86
29	7.4	-0.068	694	278	356	390	361	1167	415.7	447	86
30	7.2	-0.068	695	279	357	391	363	1154	416.8	449	86
31	7	-0.068	700	279	358	392	365	1190	418.9	451	87
32	6.9	-0.068	707	280	360	394	367	1196	421.5	453	87
33	6.7	-0.069	709	281	362	396	368	1226	423.3	454	87
34	6.6	-0.068	717	282	364	398	370	1217	426.3	455	87
35	6.5	-0.068	721	283	367	400	372	1185	428.7	458	87
36	6.3	-0.068	731	284	370	402	374	1256	432	460	87
37	6.2	-0.068	741	284	373	405	376	1190	435.7	463	88
38	6	-0.068	748	284	376	408	378	1256	438.8	466	88
39	5.8	-0.069	759	285	379	410	380	1212	442.6	468	86
40	5.7	-0.068	768	286	381	413	383	1279	446.1	470	86
41	5.5	-0.068	775	286	384	416	385	1236	449.2	471	86
42	5.3	-0.068	778	287	387	419	387	1210	451.8	472	86

## Wood Heater Preburn Data - ASTM E2780

**Run: 3**

Technician Signature \_\_\_\_\_

Manufacturer: MF Fire  
 Model: Nova C  
 Tracking No.: 2468  
 Project No.: 0552WS003E  
 Test Date: 7.12.2023

Beginning Clock Time: \_\_\_\_\_

Preburn Fuel Data					
_____	1	pieces @	_____	144	inches
_____	_____	pieces @	_____	_____	inches
_____	_____	pieces @	_____	_____	inches
Fuel Moisture Readings (% DB):					
			22.8		
			23.4		
			23.7		
Avg Preburn Moisture (% DB):			<b>23.30</b>		

Coal Bed	<b>2.6</b>	<b>3.2</b>
Range (lb):	(min)	(max)

Elapsed Time (min)	Scale (lb)	Stack Draft (in H <sub>2</sub> O)	Temperatures (°F)								
			FB Top	FB Bottom	FB Back	FB Left	FB Right	Cat Exit	Avg. FB	Stack	Ambient
43	5.2	-0.068	786	288	390	422	390	1283	455.3	473	88
44	5	-0.069	791	289	394	424	392	1210	458	474	89
45	4.8	-0.069	793	290	396	427	394	1213	459.9	474	88
46	4.6	-0.069	791	291	399	431	396	1234	461.5	475	89
47	4.5	-0.069	800	292	401	434	398	1222	464.9	475	90
48	4.3	-0.07	800	293	404	437	399	1277	466.6	474	86
49	4.2	-0.069	801	293	407	440	401	1216	468.6	473	86
50	4.1	-0.07	799	295	410	443	402	1225	469.6	471	87
51	3.9	-0.068	800	295	413	445	404	1238	471.5	469	87
52	3.8	-0.069	799	296	415	448	405	1299	472.8	469	86
53	3.7	-0.069	797	297	419	451	407	1299	474.1	468	87
54	3.6	-0.069	791	299	422	453	408	1260	474.5	467	87
55	3.5	-0.069	785	299	426	456	409	1195	475	467	87
56	3.4	-0.068	780	301	429	458	411	1181	475.7	465	87
57	3.3	-0.067	776	302	432	460	412	1184	476.5	463	87
58	3.2	-0.067	764	303	435	463	413	1168	475.4	461	87
59	3.1	-0.068	757	303	438	465	414	1226	475.5	460	86
60	3	-0.067	749	304	441	467	415	1145	475.4	457	88
61	2.9	-0.066	736	305	444	469	417	1129	474.4	454	87
62	2.9	-0.066	730	306	448	471	418	1129	474.7	453	86
63	2.8	-0.066	721	307	451	473	419	1100	474.3	450	87
64	1.3	-0.061	712	308	455	474	420	1111	473.7	447	87



Run: 3 Manufacturer: MF Fire Model: Nova C Tracking No.: 2468 Project No.: 202306000E Technician Signature: \_\_\_\_\_ Beginning Clock Time: 7:12:25.23 Background Sample Volume: 24.184 cubic feet Total Sampling Time: 151 min Recording Interval: 6 min Dilution Tunnel MM(dry): 23.06 lbs/mole Dilution Tunnel MM(wet): 28.73 lbs/mole Dilution Tunnel MM(H<sub>2</sub>O): 238.1 scfm Post-Test Leak Check (1): \_\_\_\_\_ in. Hg Post-Test Leak Check (2): \_\_\_\_\_ in. Hg Average Test Piece Fuel Moisture: 21.04 Dry Basis %

PM Control Modules: 23.06 lbs/mole Avg. Tunnel Velocity: \_\_\_\_\_ in. Hg Dilution Tunnel MM(dry): 23.06 lbs/mole Initial Tunnel Flow: \_\_\_\_\_ scfm Dilution Tunnel MM(wet): 28.73 lbs/mole Avg. Tunnel Velocity: \_\_\_\_\_ in. Hg Dilution Tunnel MM(H<sub>2</sub>O): 238.1 scfm Post-Test Leak Check (1): \_\_\_\_\_ in. Hg Post-Test Leak Check (2): \_\_\_\_\_ in. Hg Average Test Piece Fuel Moisture: 21.04 Dry Basis %

Velocity Traverse Data table with columns: Pt.1-Pt.8, Vel, W, H<sub>2</sub>O, F, %

Temperature Data (F) table with columns: Avg. Stove Surface, F<sub>box</sub> Back, Bottom, Top, Left, Right, F<sub>cat</sub>, F<sub>ex</sub>

Fuel Weight (lb) table with columns: Pro. Rate Pro. Rate, Weight Change, F<sub>box</sub> Back, Bottom, Top, Left, Right, F<sub>cat</sub>, F<sub>ex</sub>

Stack Gas Data table with columns: CO, CO<sub>2</sub>, O<sub>2</sub>, H<sub>2</sub>O, Ambient, Driver Ext 2, Filter 2, Driver Ext 1, Filter 1, Catalyst, Stack, Driver, Ambient

Meter Box Y Factor: 1.007 (1) 1.015 (2) 1.012 (Amb) Room Air Velocity: 16 Room Air Velocity: 16

Barometric Pressure: 29.88 Middle 30.00 Average 29.89

OMNI Equipment Numbers:

Main test data table with columns: Tor, Avg, Gas Meter 1, Gas Meter 2, Sample Rate 1, Sample Rate 2, Office dH<sub>2</sub>O, Office dH<sub>2</sub>O, Meter 1 Vacuum, Meter 2 Vacuum, Meter 1 Temp, Meter 2 Temp, Dilution Tunnel, Pro. Rate Pro. Rate, Fuel Weight, F<sub>box</sub> Back, Bottom, Top, Left, Right, F<sub>cat</sub>, F<sub>ex</sub>, Avg. Stove Surface, F<sub>box</sub> Back, Bottom, Top, Left, Right, F<sub>cat</sub>, F<sub>ex</sub>, Driver, Ambient, CO, CO<sub>2</sub>, O<sub>2</sub>, H<sub>2</sub>O





Wood Heater Test Data

Run: 3
Manufacturer: MF Fire
Model: Nova C
Tracking No.: 2483
Project No.: 2023012600E
Date Tested: 7/12/2023
Beginning Clock Time:
Background Sample Volume: 24.184 cubic feet

PM Control Modules:
Dilution Tunnel MM(dry): 23.06 lb/mole
Initial Tunnel Velocity: 232.3 ft/dm
Average Chamber Temp: 238.1 f/dm
Post-Test Leak Check (1): 21.04 f/dm
Post-Test Leak Check (2): 21.04 f/dm

Technician Signature:

Table with columns: Meter Box Y Factor, (1), 1.015, (2), 1.012, (Amb), Room Air Velocity, f/dm. Values: 29.98, 30.00, 29.99, 16.

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OMNI Equipment Numbers:
Velocity Traverse Data
Temp: 139, 139, 139, 139, 139, 139, 139, 139
V\_sov: 22.80 f/dm
V\_sont: 22.94 f/dm
F\_p: 0.894

Main data table with columns:Elapsed Time, Gas Meter 1, Gas Meter 2, Sample Rate 1, Sample Rate 2, Office dH1, Office dH2, Meter 1 Vacuum, Meter 2 Vacuum, Dilution Tunnel, Pro. Rate Pro. Rate 2, Fuel Weight Scale, Fuel Weight Change, Firebox Bottom, Firebox Back, Firebox Left, Firebox Right, Avg. Stove Surface Temperature, Stack, Filter 1, Filter 2, Drier Exit 1, Drier Exit 2, Ambient, Draift (H2O), CO2 (%), CO (%).

# Wood Heater Test Data

U

Run: 3

Manufacturer: MF Fire  
 Model: Nova C  
 Tracking No.: 2483  
 Project No.: 202306030E  
 Date: 7/12/2023  
 Beginning Clock Time:

Total Sampling Time: 151 min  
 Recording Interval: 6 min  
 Background Sample Volume: 24,184 cubic feet

PM Control Modules:  
 Dilution Tunnel MM(dry): 23.06 lb-b-mole  
 Dilution Tunnel MM(wet): 232.3 lb-b-mole  
 Dilution Tunnel Size: 2.00 in. ID  
 Dilution Tunnel Area: 3.14 sq. ft.  
 Tunnel Area: 0.18535 sq. ft.  
 Pilot Tube Cp: 0.59  
 Average Test Piece Fuel Moisture: 21.04 Dry Basis %

Technician Signature:

Avg. Tunnel Velocity: 23.06 ft/sec.  
 Initial Tunnel Flow: 232.3 scfm  
 Avg. Baghouse Velocity: 238.1 scfm  
 Post-Test Leak Check (1): in. Hg  
 Post-Test Leak Check (2): in. Hg  
 Average Test Piece Fuel Moisture: 21.04 Dry Basis %

Velocity Traverse Data									
	PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8	Center
Initial dp	0.102	0.108	0.106	0.100	0.100	0.106	0.110	0.104	0.106
Temp:	139	139	139	139	140	140	139	139	138

V<sub>avg</sub> 22.80 ft/sec      V<sub>cent</sub> 22.94 ft/sec      q<sub>wq</sub>

Meter Box Y Factor: 1.007 (1) 1.015 (2) 1.012 (Amb)

Barometric Pressure:			Room Air Velocity (ft/min)
Begin	Middle	End	Average
29.98		30.00	29.99

OMNI Equipment Numbers:

Export to PDF

Elapsed Time (min)	Particulate Sampling Data										Fuel Weight (lb)										Temperature Data (F)										Stack Gas Data				
	Gas Meter 1 (ft <sup>3</sup> )	Gas Meter 2 (ft <sup>3</sup> )	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dh1 (H <sub>2</sub> O) (in. Hg)	Meter 1 Temp (°F)	Orifice dh2 (H <sub>2</sub> O) (in. Hg)	Meter 2 Temp (°F)	Meter 2 Vacuum (in. Hg)	Dilution Tunnel Center dp	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firbox Top	Firbox Bottom	Firbox Back	Firbox Left	Firbox Right	Avg. Stove Surface (Tot=All)	Catalyst Exit	Stack	Filter 1	Drier Exit 1	Filter 2	Drier Exit 2	Ambient	Draft (H <sub>2</sub> O)	CO <sub>2</sub> (%)	CO (%)					
133	21.458	21.426	0.16	0.16	1.22	99	2.11	0.96	101	1.6	125	0.108	100	101	0.7	0	510	317	438	424	379	414	854	375	83	61	87	46	87	-0.059	5.04	0.02			
134	21.520	21.589	0.16	0.16	1.22	99	2.11	0.96	101	1.6	125	0.107	101	101	0.6	-0.1	510	317	437	424	379	413	850	375	83	61	87	46	87	-0.058	5.08	0.02			
135	21.782	21.751	0.16	0.16	1.22	99	2.11	0.96	101	1.6	125	0.105	102	102	0.7	0.1	509	317	437	424	379	413	848	375	83	61	87	46	86	-0.058	5.06	0.02			
136	21.944	21.915	0.16	0.16	1.22	99	2.11	0.96	101	1.6	125	0.108	100	101	0.6	-0.1	510	317	436	424	378	413	850	374	84	61	87	46	87	-0.059	5.05	0.02			
137	22.105	22.078	0.16	0.16	1.22	99	2.11	0.96	101	1.6	125	0.106	101	102	0.6	0	509	317	436	423	378	413	851	374	84	61	87	46	87	-0.059	5.06	0.02			
138	22.266	22.240	0.16	0.16	1.22	99	2.11	0.96	101	1.6	125	0.110	99	99	0.5	-0.1	508	318	435	423	378	413	850	374	84	61	87	46	87	-0.058	5.08	0.02			
139	22.428	22.403	0.16	0.16	1.22	99	2.11	0.96	101	1.6	125	0.107	101	101	0.5	0	509	318	435	423	377	412	850	374	84	61	87	46	87	-0.058	5.05	0.02			
140	22.589	22.566	0.16	0.16	1.22	100	2.11	0.96	101	1.6	125	0.107	100	101	0.5	0	507	318	435	421	377	411	850	373	84	61	87	46	87	-0.058	5.06	0.02			
141	22.750	22.730	0.16	0.16	1.22	100	2.11	0.96	101	1.6	125	0.109	99	101	0.4	-0.1	507	318	434	421	377	411	850	373	84	61	88	46	87	-0.058	5.04	0.02			
142	22.913	22.892	0.16	0.16	1.22	100	2.11	0.96	101	1.6	125	0.109	100	100	0.4	0	506	318	434	421	376	411	848	373	85	61	88	46	87	-0.059	4.99	0.02			
143	23.074	23.055	0.16	0.16	1.22	100	2.11	0.96	101	1.6	125	0.109	99	100	0.4	0	505	318	434	421	375	411	847	373	85	61	88	46	87	-0.058	5.01	0.02			
144	23.235	23.218	0.16	0.16	1.22	99	2.11	0.96	101	1.6	128	0.108	100	101	0.3	-0.1	504	319	433	420	376	410	845	373	85	61	88	46	86	-0.058	4.95	0.02			
145	23.397	23.381	0.16	0.16	1.22	99	2.11	0.95	101	1.6	125	0.107	101	101	0.4	0.1	503	319	433	419	375	410	844	373	85	61	88	46	87	-0.058	4.93	0.02			
146	23.558	23.544	0.16	0.16	1.23	99	2.11	0.96	101	1.6	125	0.109	99	100	0.4	0	502	320	433	419	375	410	844	372	85	61	88	46	87	-0.058	4.97	0.02			
147	23.719	23.707	0.16	0.16	1.22	99	2.11	0.96	101	1.6	125	0.111	98	99	0.3	-0.1	501	320	432	419	374	409	844	371	85	61	88	46	87	-0.058	4.92	0.02			
148	23.882	23.870	0.16	0.16	1.22	99	2.11	0.96	101	1.6	125	0.105	102	102	0.2	-0.1	500	320	432	418	374	409	843	373	85	61	88	46	87	-0.058	4.93	0.02			
149	24.044	24.032	0.16	0.16	1.22	99	2.11	0.96	101	1.6	124	0.106	101	101	0.1	-0.1	500	320	432	418	374	409	843	373	85	61	88	46	87	-0.058	4.93	0.02			
150	24.205	24.196	0.16	0.16	1.22	99	2.11	0.96	101	1.6	124	0.112	98	99	0.2	0.1	497	319	431	417	374	408	842	372	85	61	88	46	87	-0.058	4.88	0.02			
151	24.367	24.359	0.16	0.16	1.22	99	2.11	0.96	101	1.6	125	0.107	101	101	0.0	-0.2	497	319	431	417	374	408	844	371	85	61	88	46	86	-0.058	4.86	0.02			

## Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire \_\_\_\_\_ Equipment Numbers: \_\_\_\_\_  
 Model: Nova C \_\_\_\_\_  
 Tracking No.: 2468 \_\_\_\_\_  
 Project No.: 0552WS003E \_\_\_\_\_  
 Run #: 3 \_\_\_\_\_  
 Date: 7.12.2023 \_\_\_\_\_

**TRAIN 1 (First Hour emissions)**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter				0.0
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:    0.0

**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	E997	122.3	118.5	3.8
C. Rear filter catch	Filter	E998	118.1	118.1	0.0
D. Probe catch*	Probe	OES5	113570.5	113570.2	0.3
E. Filter seals catch*	Seals	S531	3381.0	3381.0	0.0

**Sub-Total**    Total Particulate, mg:    4.1

**Train 1 Aggregate**    Total Particulate, mg:    4.1

**TRAIN 2**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	E999	122.1	118.2	3.9
B. Rear filter catch	Filter	F000	117.7	117.6	0.1
C. Probe catch*	Probe	OES6	113710.2	113710.0	0.2
D. Filter seals catch*	Seals	S531	3362.8	3362.8	0.0

**Total Particulate, mg:    4.2**

**AMBIENT**

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch*	Filter		118.4	118.2	0.2

**Total Particulate, mg:    0.2**

\*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: \_\_\_\_\_

## Run 3 First Hour Emissions Data

# Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire  
 Model: Nova C  
 Project No.: 0552WS003E  
 Tracking No.: 2468  
 Run: 3  
 Test Date: 7.12.2023

Technician Signature: \_\_\_\_\_

Burn Rate  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	<p style="text-align: center;"><b>4.80 kg/hr dry</b></p> 138 degrees Fahrenheit 23.55 feet/second 14428.1 dscf/hour  0.113 inches H2O 60 minutes
--	---

	AMBIENT		SAMPLE TRAIN 1		SAMPLE TRAIN 2		FIRST HOUR FILTER (TRAIN 1)				
							First Hour	Train 1	Train 2	Complies?	
Total Sample Volume - Vm	24.184 cubic feet	9.654 cubic feet	0.000 cubic feet	9.654 cubic feet	0.000 cubic feet	9.654 cubic feet	9.654	85 degrees Fahrenheit	85 degrees Fahrenheit	9.654 dscf	OK
Average Gas Meter Temperature	87 degrees Fahrenheit	85 degrees Fahrenheit	85 degrees Fahrenheit	85 degrees Fahrenheit	85 degrees Fahrenheit	85 degrees Fahrenheit	85	degrees Fahrenheit	degrees Fahrenheit	degrees Fahrenheit	OK
Total Sample Volume (Standard Conditions) - Vmst	23.658 dscf	9.545 dscf	9.545 dscf	9.545 dscf	9.545 dscf	9.545 dscf	9.545	dscf	dscf	dscf	OK
Total Particulates - m <sub>p</sub>	0 mg	4.8 mg	4.8 mg	4.8 mg	4.8 mg	4.8 mg	4.8	mg	mg	mg	OK
Particulate Concentration (dry-standard) - C <sub>p</sub> /C <sub>s</sub>	0.000000 grams/dscf	0.00050 grams/dscf	0.00050 grams/dscf	0.00050 grams/dscf	0.00050 grams/dscf	0.00050 grams/dscf	0.00050	grams/dscf	grams/dscf	grams/dscf	OK
Total Particulate Emissions - E <sub>T</sub>	0.00 grams	7.26 grams	7.26 grams	7.26 grams	7.26 grams	7.26 grams	7.26	grams	grams	grams	OK
Particulate Emission Rate	0.00 grams/hour	7.26 grams/hour	7.26 grams/hour	7.26 grams/hour	7.26 grams/hour	7.26 grams/hour	7.26	grams/hour	grams/hour	grams/hour	OK
Emissions Factor	0.00 grams/kg	1.51 g/kg	1.51 g/kg	1.51 g/kg	1.51 g/kg	1.51 g/kg	1.51	g/kg	g/kg	g/kg	OK
Difference from Average Total Particulate Emissions	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	grams	grams	grams	OK
<b>Final Average Results</b>											
<b>Complete Test Run</b>											
Total Particulate Emissions - E <sub>T</sub>	#DIV/0!	grams	grams	grams	grams	grams	grams	grams	grams	grams	OK
Particulate Emission Rate	#DIV/0!	grams/hour	grams/hour	grams/hour	grams/hour	grams/hour	grams/hour	grams/hour	grams/hour	grams/hour	OK
Emissions Factor	#DIV/0!	grams/kg	grams/kg	grams/kg	grams/kg	grams/kg	grams/kg	grams/kg	grams/kg	grams/kg	OK
<b>First Hour Emissions</b>											
Total Particulate Emissions - E <sub>T</sub>	7.26	grams	grams	grams	grams	grams	grams	grams	grams	grams	OK
Particulate Emission Rate	7.26	grams/hour	grams/hour	grams/hour	grams/hour	grams/hour	grams/hour	grams/hour	grams/hour	grams/hour	OK
Emissions Factor	64.54	grams/kg	grams/kg	grams/kg	grams/kg	grams/kg	grams/kg	grams/kg	grams/kg	grams/kg	OK
7.5% of Average Total Particulate Emissions	#DIV/0!	grams	grams	grams	grams	grams	grams	grams	grams	grams	OK
		(min / max)	< 55	> 90							OK
		Train Precision	(A) Within 7.5%	(B) Within 0.5 g/kg							OK
		One of A or B must	Within 125 °F								OK
		Stove Surface ΔT	< 50 fpm								OK
		Room Air Velocity									OK





# Wood Heater Test Data

Run: **3**

Manufacturer: MF Fire  
 Model: Nova C  
 Tracking No.: 2483  
 Project No.: 20230303E  
 Date: 7/12/2023  
 Beginning Clock Time: \_\_\_\_\_

Total Sampling Time: 69 min  
 Recording Interval: 6 min  
 Background Sample Volume: 24,184 cubic feet

PM Control Modules: 371.338  
 Dilution Tunnel MM(dry): 29.00 lbb-mole  
 Dilution Tunnel MM(wet): 28.73 lbb-mole  
 Dilution Tunnel SFC: 2.00 lbm  
 Tunnel Area: 3.0002 sqm  
 Post-Test Leak Check (1): 15 in. Hg  
 Post-Test Leak Check (2): 46 in. Hg  
 Plot Tube Cp: 0.599  
 Plot Tube Cv: 21.04 Dry Basis %

Technician Signature: \_\_\_\_\_

Meter Box Y Factor: 1.014 (1) 1.015 (2) 1.012 (Amb)

Biometric Pressure:	Begin	Middle	End	Average
	29.88	30.00	29.89	16

Room Air Velocity: 16 fpm

Velocity Traverse Data		Fuel Weight (lb)		Temperature Data (F)		Stack Gas Data		
PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8	Center
Initial dp	0.102	0.108	0.106	0.100	0.106	0.110	0.104	0.106
Temp:	138	139	139	139	140	140	139	138
V <sub>ave</sub>	22.80		f/sec		22.94		f/sec	
F <sub>p</sub>	0.894		%		0.894		%	

OMNI Equipment Numbers: \_\_\_\_\_

Elapsed Time (min)	Gas Meter 1 (ft <sup>3</sup> )	Gas Meter 2 (ft <sup>3</sup> )	Particulate Sampling Data				Fuel Weight (lb)				Temperature Data (F)				Stack Gas Data															
			Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH1 (H <sub>2</sub> O)	Meter 1 Temp (°F)	Meter 2 Vacuum (Hg)	Orifice dH2 (H <sub>2</sub> O)	Meter 2 Temp (°F)	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Dilution Tunnel Center dp	Dilution Tunnel (F)	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface (Tot=At)	Stack Exit	Catalyst Exit	Stack	Filter 1	Filter 2	Driver Exit 2	Ambient	Draft (H <sub>2</sub> O)	CO <sub>2</sub> (%)
31	4.786	0.17	0.17	2.34	86	-2.48	2.34	86	-2.48	139	0.114	103	6.5	-0.1	808	324	440	472	422	483	1156	492	87	64	81	44	89	-0.072	8.3	0.09
32	4.963	0.17	0.17	2.35	85	-2.93	2.35	85	-2.93	137	0.114	103	6.3	-0.2	794	324	442	472	423	491	1123	497	87	64	82	44	88	-0.071	7.8	0.05
33	5.131	0.17	0.17	2.37	86	-2.78	2.37	86	-2.78	137	0.114	105	6.2	-0.1	780	324	444	473	424	489	1114	482	87	64	83	44	87	-0.070	7.45	0.03
34	5.299	0.17	0.17	2.36	86	-2.39	2.36	86	-2.39	136	0.114	104	6.1	-0.1	767	324	445	474	425	487	1115	478	86	64	83	45	86	-0.071	7.19	0.02
35	5.467	0.17	0.17	2.34	86	-2.68	2.34	86	-2.68	135	0.110	105	6.0	-0.1	755	324	447	475	426	485	1088	474	86	65	83	45	87	-0.070	7.02	0.02
36	5.635	0.17	0.17	2.34	86	-2.66	2.34	86	-2.66	135	0.115	103	5.9	-0.1	743	324	448	475	427	483	1081	471	86	65	83	45	86	-0.070	6.84	0.02
37	5.803	0.17	0.17	2.34	86	-2.54	2.34	86	-2.54	135	0.113	104	5.8	-0.1	734	323	449	475	427	482	1097	468	86	65	83	45	87	-0.070	6.89	0.01
38	5.971	0.17	0.17	2.36	86	-2.89	2.36	86	-2.89	134	0.114	104	5.7	-0.1	727	323	451	476	428	481	1090	465	86	65	83	45	87	-0.069	6.85	0.01
39	6.139	0.17	0.17	2.40	86	-2.48	2.40	86	-2.48	134	0.112	104	5.6	-0.1	719	323	451	475	428	479	1099	462	87	65	83	46	87	-0.068	6.89	0.02
40	6.307	0.17	0.17	2.36	86	-2.9	2.36	86	-2.9	134	0.114	104	5.6	0	711	322	452	476	428	478	1110	460	87	66	83	46	87	-0.069	6.87	0.02
41	6.475	0.17	0.17	2.38	86	-2.45	2.38	86	-2.45	134	0.113	104	5.5	-0.3	706	322	453	475	429	477	1121	457	87	66	83	46	87	-0.069	6.89	0.01
42	6.644	0.17	0.17	2.35	86	-2.69	2.35	86	-2.69	134	0.115	104	5.4	0.1	703	322	454	475	429	477	1085	456	87	66	83	46	87	-0.069	6.89	0.02
43	6.812	0.17	0.17	2.35	86	-2.6	2.35	86	-2.6	136	0.111	105	5.1	-0.3	702	320	454	475	428	476	1094	454	87	62	83	46	87	-0.068	7.06	0.02
44	6.980	0.17	0.17	2.34	86	-2.54	2.34	86	-2.54	136	0.111	105	5.0	-0.1	704	320	455	475	428	476	1162	454	88	61	83	46	87	-0.067	7.06	0.03
45	7.148	0.17	0.17	2.35	86	-2.43	2.35	86	-2.43	135	0.112	105	4.9	-0.1	702	318	456	475	428	476	1143	453	88	60	83	46	87	-0.067	7.26	0.04
46	7.315	0.17	0.17	2.33	86	-2.48	2.33	86	-2.48	134	0.109	105	4.8	-0.1	706	318	456	474	428	476	1139	453	88	60	83	46	87	-0.067	7.49	0.04
47	7.482	0.17	0.17	2.33	86	-2.67	2.33	86	-2.67	134	0.112	104	4.7	-0.1	708	316	457	473	428	476	1132	454	88	61	83	47	87	-0.068	7.67	0.06
48	7.650	0.17	0.17	2.33	86	-2.61	2.33	86	-2.61	133	0.110	105	4.6	-0.1	710	316	457	474	429	477	1186	454	88	61	83	47	87	-0.068	7.8	0.06
49	7.817	0.17	0.17	2.32	86	-2.74	2.32	86	-2.74	133	0.110	105	4.5	-0.1	711	315	457	473	429	477	1145	454	89	61	83	47	87	-0.067	7.84	0.04
50	7.984	0.17	0.17	2.32	86	-2.41	2.32	86	-2.41	133	0.108	106	4.4	-0.1	709	314	458	474	428	477	1115	452	89	61	83	47	88	-0.068	7.5	0.01
51	8.151	0.17	0.17	2.31	86	-2.65	2.31	86	-2.65	132	0.114	103	4.3	-0.1	706	313	458	474	428	476	1095	449	89	62	83	47	88	-0.069	6.93	0.01
52	8.318	0.17	0.17	2.33	87	-2.94	2.33	87	-2.94	132	0.110	104	4.3	0	703	313	458	473	426	475	1093	447	89	62	83	47	88	-0.068	6.89	0.01
53	8.485	0.17	0.17	2.32	87	-2.93	2.32	87	-2.93	132	0.113	103	4.2	-0.1	699	312	458	474	427	474	1088	445	89	62	82	47	87	-0.068	6.51	0.01
54	8.652	0.17	0.17	2.34	87	-2.66	2.34	87	-2.66	131	0.114	102	4.1	-0.1	697	311	459	474	426	473	1155	443	89	63	82	47	87	-0.068	6.51	0.01
55	8.819	0.17	0.17	2.30	87	-2.66	2.30	87	-2.66	131	0.112	103	4.0	-0.1	694	311	459	473	425	472	1129	442	89	63	82	47	87	-0.068	6.57	0.01
56	8.986	0.17	0.17	2.31	87	-2.43	2.31	87	-2.43	130	0.112	103	3.9	-0.1	695	310	459	473	425	472	1139	441	89	63	82	47	88	-0.067	6.69	0.01
57	9.153	0.17	0.17	2.32	87	-2.54	2.32	87	-2.54	131	0.113	103	3.9	0	691	309	459	473	424	471	1098	441	88	63	82	47	87	-0.067	6.77	0.01
58	9.320	0.17	0.17	2.32	87	-2.74	2.32	87	-2.74	130	0.113	103	3.7	-0.2	688	309	460	472	423	470	1159	439	89	64	82	47	88	-0.067	6.89	0.01
59	9.487	0.17	0.17	2.33	87	-2.8	2.33	87	-2.8	129	0.108	105	3.7	0	686	309	460	472	423	470	1123	437	88	64	82	47	88	-0.067	6.19	0
60	9.654	0.17	0.17	2.33	87	-2.5	2.33	87	-2.5	130	0.112	103	3.7	0	679	307	460	471	422	468	1047	435	88	64	82	47	86	-0.067	5.72	0

## Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire \_\_\_\_\_ Equipment Numbers: \_\_\_\_\_  
 Model: Nova C \_\_\_\_\_  
 Tracking No.: 2468 \_\_\_\_\_  
 Project No.: 0552WS003E \_\_\_\_\_  
 Run #: 3 \_\_\_\_\_  
 Date: 7.12.2023 \_\_\_\_\_

**TRAIN 1 (First Hour emissions)**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	F001	122.1	118.1	4.0
C. Rear filter catch	Filter	F003	118.4	118.3	0.1
D. Probe catch*	Probe	75	117638.0	117637.9	0.1
E. Filter seals catch*	Seals	S531	3435.8	3435.2	0.6

**Sub-Total**    Total Particulate, mg:    4.8

**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				0.0
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:    0.0

**Train 1 Aggregate**    Total Particulate, mg:    4.8

**TRAIN 2**

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

Total Particulate, mg:    0.0

**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: \_\_\_\_\_

# OMNI-Test Laboratories

**Manufacturer:** MF Fire  
**Model:** Nova C  
**Date:** 07/12/23  
**Run:** 3  
**Control #:**  
**Test Duration:** 151  
**Output Category:** SBR

**Technicians:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## Test Results in Accordance with CSA B415.1-10

	HHV Basis	LHV Basis
Overall Efficiency	62.3%	67.3%
Combustion Efficiency	98.2%	98.2%
Heat Transfer Efficiency	63%	68.5%

Output Rate (kJ/h)	23,522	22,313	(Btu/h)
Burn Rate (kg/h)	1.91	4.20	(lb/h)
Input (kJ/h)	37,770	35,829	(Btu/h)

Test Load Weight (dry kg)	4.80	10.58	dry lb
MC wet (%)	17.38		
MC dry (%)	21.04		
Particulate (g)	0		
CO (g)	170		
Test Duration (h)	2.52		

Emissions	Particulate	CO
g/MJ Output	0.00	2.87
g/kg Dry Fuel	0.00	35.44
g/h	0.00	67.57
lb/MM Btu Output	0.00	6.68

Air/Fuel Ratio (A/F)	17.62
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VERSION:

2.4

4/15/2010

VERSION: 2.4 4/15/2010

Manufacturer: MF Fire  
 Model: Nova C  
 Date: 7/12/2023  
 Run: 3  
 Control #:   
 Test Duration: 151  
 Output Category: SBR

Appliance Type: Cat (Cat, Non-Cat, Pellet)

Temp. Units F (F or C)  
 Weight Units lb (kg or lb)

**Default Fuel Values**

	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

Wood Moisture (% wet): 17.38  
 Load Weight (lb wet): 12.80  
 Burn Rate (dry kg/h): 1.91  
 Total Particulate Emissions: g

**Fuel Data**

	D. Fir	kJ/kg
HHV	19,810	
%C	48.73	
%H	6.87	
%O	43.9	
%Ash	0.5	

Note 1: For other fuels, use the heating value and fuel composition determined by analysis of fuel sample in accordance with Clause 9.2.

Averages 0.11 5.93 #DIV/0! 423.59 87.05

Elapsed Time (min)	Fuel Weight Remaining (lb)	Flue Gas Composition (%)			Temp. (°F)	
		CO	CO <sub>2</sub>	O <sub>2</sub>	Flue Gas	Room Temp
0	12.80	0.00	4.00		496.0	89.0
1	12.60	0.01	2.63		456.0	89.0
2	12.50	0.07	1.91		452.0	87.0
3	12.30	0.01	4.61		453.0	88.0
4	12.10	0.01	4.62		453.0	87.0
5	11.90	0.07	5.35		459.0	87.0
6	11.70	1.05	6.63		472.0	88.0
7	11.40	0.95	7.50		481.0	87.0
8	11.20	0.53	7.37		485.0	87.0
9	11.00	0.54	7.30		488.0	86.0
10	10.70	0.54	7.17		492.0	87.0
11	10.50	0.48	6.13		493.0	88.0
12	10.30	0.40	5.68		495.0	87.0
13	10.10	0.39	5.93		497.0	88.0
14	9.90	0.13	1.88		499.0	87.0
15	9.60	0.44	6.25		500.0	88.0
16	9.40	0.55	7.97		502.0	86.0
17	9.20	0.24	3.79		503.0	87.0
18	9.00	0.69	10.63		504.0	87.0
19	8.70	0.67	10.51		504.0	87.0
20	8.50	0.69	10.38		506.0	87.0
21	8.30	0.70	10.67		506.0	87.0
22	8.10	0.02	0.76		506.0	87.0
23	7.90	0.27	3.43		507.0	87.0
24	7.70	0.72	10.21		506.0	88.0
25	7.50	0.81	11.01		506.0	88.0
26	7.30	0.91	11.01		507.0	88.0
27	7.00	1.05	11.05		505.0	87.0
28	6.90	1.17	11.06		505.0	87.0
29	6.70	0.61	10.41		501.0	88.0
30	6.60	0.23	9.29		497.0	88.0
31	6.50	0.09	8.30		492.0	89.0
32	6.30	0.05	7.78		487.0	88.0
33	6.20	0.03	7.45		482.0	87.0
34	6.10	0.02	7.19		478.0	86.0
35	6.00	0.02	7.02		474.0	87.0
36	5.90	0.02	6.94		471.0	86.0
37	5.80	0.01	6.89		468.0	87.0
38	5.70	0.01	6.85		465.0	87.0
39	5.60	0.02	6.89		462.0	87.0
40	5.60	0.02	6.87		460.0	87.0
41	5.30	0.01	6.89		457.0	87.0
42	5.40	0.02	6.99		456.0	87.0
43	5.10	0.02	7.06		454.0	87.0
44	5.00	0.03	7.06		454.0	87.0
45	4.90	0.04	7.26		454.0	87.0
46	4.80	0.04	7.49		453.0	87.0
47	4.70	0.06	7.67		454.0	87.0
48	4.60	0.06	7.80		454.0	87.0
49	4.50	0.04	7.84		454	87
50	4.40	0.01	7.5		452	88
51	4.30	0.01	6.93		449	88
52	4.30	0.01	6.59		447	88
53	4.20	0.01	6.5		445	87
54	4.10	0.01	6.51		443	87

Note 2: In cases where the "Fuel Weight Remaining" is the same for three or more readings in a row, a "divide by zero error" will occur in the calculation sheet. In such cases, adjust the weight values by interpolation between the first occurrence and the next reading showing a decrease in weight.

55	4.00	0.01	6.57	442	87
56	3.90	0.01	6.69	441	88
57	3.90	0.01	6.77	441	87
58	3.70	0.01	6.58	439	87
59	3.70	0	6.19	437	88
60	3.70	0	5.72	435	86
61	3.50	0.01	5.23	433	87
62	3.50	0.01	5.08	430	88
63	3.40	0.01	4.93	427	87
64	3.40	0.01	4.88	424	88
65	3.30	0.01	4.85	422	88
66	3.30	0.01	4.82	420	87
67	3.20	0.01	4.82	418	88
68	3.20	0.01	4.84	417	87
69	3.20	0.01	4.99	415	87
70	3.10	0.01	4.95	414	87
71	3.00	0.01	5.09	412	87
72	2.90	0.01	5.26	410	87
73	2.90	0.01	5.61	408	87
74	2.90	0.01	5.75	408	87
75	2.70	0.01	5.89	407	87
76	2.70	0.01	6.06	407	86
77	2.60	0.01	5.97	407	86
78	2.60	0.01	5.98	406	86
79	2.50	0.01	6.04	406	87
80	2.40	0.01	5.92	405	86
81	2.40	0.01	5.84	405	87
82	2.30	0.01	5.75	404	88
83	2.40	0.01	5.39	402	86
84	2.20	0.01	5.27	402	87
85	2.20	0.01	5.23	401	86
86	2.20	0.01	5.17	399	87
87	2.20	0.01	5.15	398	87
88	2.10	0.01	5.36	398	87
89	2.10	0.01	5.35	397	86
90	2.00	0.01	5.34	396	86
91	1.90	0.01	5.28	396	87
92	2.00	0.01	5.21	396	87
93	1.90	0.01	5.2	395	87
94	1.80	0.01	5.11	395	87
95	1.80	0.01	5.08	395	87
96	1.80	0.01	5.03	393	87
97	1.70	0.02	4.99	392	87
98	1.70	0.02	4.94	392	86
99	1.70	0.01	4.92	391	87
100	1.60	0.01	4.91	389	87
101	1.70	0.01	4.93	389	87
102	1.60	0.01	4.98	387	86
103	1.70	0.01	5.06	386	87
104	1.50	0.01	5.14	385	87
105	1.50	0.01	5.17	384	87
106	1.50	0.01	5.23	382	87
107	1.50	0.01	5.31	382	87
108	1.40	0.01	5.35	381	87
109	1.40	0.01	5.35	381	87
110	1.40	0.01	5.4	381	87
111	1.30	0.01	5.4	380	88
112	1.30	0.01	5.39	379	87
113	1.20	0.01	5.38	379	87
114	1.20	0.01	5.42	378	87
115	1.20	0.01	5.37	379	87
116	1.10	0.01	5.37	378	86
117	1.10	0.01	5.35	378	87
118	1.10	0.01	5.35	378	87
119	1.00	0.01	5.31	377	87
120	1.00	0.01	5.34	378	87
121	1.00	0.01	5.3	378	87
122	0.90	0.01	5.2	377	86
123	0.90	0.01	5.1	376	87
124	0.90	0.01	5.06	376	87
125	0.90	0.01	5.04	375	87
126	0.80	0.02	5.1	375	88
127	0.80	0.02	5.13	375	86
128	0.90	0.02	5.19	374	86

129	0.70	0.02	5.2		375	87
130	0.70	0.02	5.14		374	87
131	0.70	0.02	5.24		374	87
132	0.70	0.02	5.16		375	87
133	0.70	0.02	5.04		375	87
134	0.60	0.02	5.08		375	87
135	0.70	0.02	5.06		375	86
136	0.60	0.02	5.05		374	87
137	0.60	0.02	5.06		374	87
138	0.50	0.02	5.08		374	87
139	0.50	0.02	5.05		374	87
140	0.50	0.02	5.06		374	87
141	0.40	0.02	5.04		373	87
142	0.40	0.02	4.99		373	87
143	0.40	0.02	5.01		373	87
144	0.30	0.02	4.95		373	86
145	0.40	0.02	4.93		373	87
146	0.40	0.02	4.97		372	87
147	0.30	0.02	4.92		371	87
148	0.20	0.02	4.93		373	87
149	0.10	0.02	4.93		373	87
150	0.20	0.02	4.88		372	87
151	0.00	0.02	4.86		371	86

### ASTM E2780 Wood Heater Run Sheets

Client: MF Fire \_\_\_\_\_ Project Number: 0552WS003E \_\_\_\_\_ Run Number: 3 \_\_\_\_\_  
 Model: Nova C \_\_\_\_\_ Tracking Number: 2468 \_\_\_\_\_ Date: 7/12/2023 \_\_\_\_\_  
 Test Crew: RT \_\_\_\_\_  
 OMNI Equipment ID numbers: \_\_\_\_\_

#### Wood Heater Run Notes

##### Air Control Settings

Primary:

Fixed (single burn rate unit)

Secondary: N/A

Tertiary/Pilot: N/A

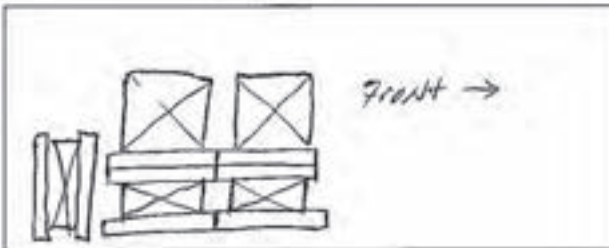
Fan: N/A

##### Preburn Notes

Time	Notes
1530	startup fuel ignited
1637	At 2.5 lbs (startup) Preburn was loaded
1742	At 2.7 lbs (preburn) preburn was stopped

##### Test Notes

Sketch test fuel configuration:



Start up procedures & Timeline:

Bypass: Used  
 Fuel loaded by: CS  
 Door closed at: 30  
 Primary air: N/A

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Time	Notes
1743	Test start
1843	First hour replace turn off

Technician Signature: Steve K. Murphy

Date: 9-27-23



### ASTM E2780 Wood Heater Run Sheets

Client: MF Fire \_\_\_\_\_ Project Number: 0552WS003E \_\_\_\_\_ Run Number: 3  
 Model: Nova C \_\_\_\_\_ Tracking Number: 2468 \_\_\_\_\_ Date: 7/12/2023  
 Test Crew: RT \_\_\_\_\_  
 OMNI Equipment ID numbers: \_\_\_\_\_

#### Wood Heater Supplemental Data

Start Time: 1743 Booth #: \_\_\_\_\_

Stop Time: \_\_\_\_\_

**Stack Gas Leak Check:**

Initial:  Final:

**Sample Train Leak Check:**

A: 0.003 @ 15" Hg  
 B: 0.002 @ 15" Hg  
 15: 0.002 @ 15

Calibrations: Span Gas CO<sub>2</sub>: 16.84 CO: 4.38 ppm: 500

	Pre Test		Post Test	
	Zero	Span	Zero	Span
Time	<u>1643</u>	<u>1645</u>	<u>2020</u>	<u>2025</u>
CO <sub>2</sub>	<u>0.00</u>	<u>16.84</u>	<u>0.00</u>	<u>16.84</u>
CO	<u>0.00</u>	<u>4.38</u>	<u>0.00</u>	<u>4.38</u>

ppm 0 500 -3 498

Air Velocity (ft/min): Initial: 16 Final: 12

Scale Audit (lbs): Initial: 10.0 Final: 10.0

Pitot Tube Leak Test: Initial:  Final:

Stack Diameter (in): 6

Induced Draft: None

% Smoke Capture: 100

Flue Pipe Cleaned Prior to First Test in Series:

Date: 07/10/2023 Initials: RT

	Initial	Middle	Ending
P <sub>b</sub> (in/Hg)	<u>29.98</u>	/	<u>29.28</u>
RH (%)	<u>38</u>	/	<u>36</u>
Ambient (°F)	<u>89</u>	/	<u>89</u>

Tunnel Traverse		
Microtector Reading	dP (in H <sub>2</sub> O)	T(°F)
<u>1</u>	<u>.051</u>	<u>.102</u>
<u>2</u>	<u>-.054</u>	<u>-.108</u>
<u>3</u>	<u>-.053</u>	<u>.106</u>
<u>4</u>	<u>-.050</u>	<u>.100</u>
	<u>-.050</u>	<u>.140</u>
	<u>-.053</u>	<u>.106</u>
	<u>-.055</u>	<u>.110</u>
	<u>-.052</u>	<u>.107</u>
Center:		
	<u>.053</u>	<u>0.106</u>

Background Filter Volume: \_\_\_\_\_

Tunnel Static Pressure (in H <sub>2</sub> O):	
Beginning of Test	End of Test
<u>-.100</u>	<u>-.100</u>

Technician Signature: B/o H.A. Maga

Date: 9-27-23

### ASTM E2780 Wood Heater Run Sheets

Client: MF Fire \_\_\_\_\_ Project Number: 0552WS003E \_\_\_\_\_ Run Number: 3 \_\_\_\_\_  
 Model: Nova C \_\_\_\_\_ Tracking Number: 2468 \_\_\_\_\_ Date: 7/12/2023 \_\_\_\_\_  
 Test Crew: RT \_\_\_\_\_  
 OMNI Equipment ID numbers: \_\_\_\_\_

#### Wood Heater Fuel Data

Fuel: Douglas fir, untreated and air dried, standard grade or better dimensional lumber

Pre-Burn Fuel					
Calibration:	Cal Value (1) = 12%	Actual Reading	<u>12.0</u>		
	Cal Value (2) = 22%	Actual Reading	<u>22.0</u>		
Piece:	Length:	Reading:	Piece:	Length:	Reading:
1	<u>144</u> in	<u>22.8</u>	7	_____ in	_____
2	_____ in	<u>23.4</u>	8	_____ in	_____
3	_____ in	<u>23.7</u>	9	_____ in	_____
4	_____ in	_____	10	_____ in	_____
5	_____ in	_____	11	_____ in	_____
6	_____ in	_____	12	_____ in	_____
Total Pre-Burn Fuel Weight:		<u>9.4 lbs</u>		Pre-Burn Fuel Average Moisture: _____	
Time (clock): <u>1600</u>		Room Temperature (F): <u>78</u>		Initials: <u>RT</u>	

Test Fuel					
Firebox Volume (ft <sup>3</sup> ): <u>1.70</u>		Test Fuel Piece Length (in): <u>14</u>			
Load Weight Range (lb): <u>10.8 - 13.0</u>		Total Wet Fuel Load Weight (lb): <u>12.8</u>			
Fuel Type & Amount: 2 x 4: <u>3</u>		4 x 4: <u>2</u>			
Weight (with spacers): <u>5.2</u>		Weight (with spacers): <u>7.6</u>			
Piece:	Weight (lbs):	Moisture Readings (%DB):		Fuel Type:	
1	<u>1.7/1.4</u>	<u>20.1</u>	<u>18.5</u>	<u>20.4</u>	<u>2x4</u>
2	<u>1.7/1.3</u>	<u>22</u>	<u>23</u>	<u>22.3</u>	<u>2x4</u>
3	<u>1.7/1.4</u>	<u>23.9</u>	<u>24.1</u>	<u>24.3</u>	<u>2x4</u>
4	<u>4.1/3.7</u>	<u>20.3</u>	<u>20.3</u>	<u>20.6</u>	<u>4x4</u>
5	<u>3.5/3.3</u>	<u>24.3</u>	<u>23.6</u>	<u>22.8</u>	<u>4x4</u>
6	_____	_____	_____	_____	_____
7	_____	_____	_____	_____	_____
Spacer Moisture Readings (%DB)					
<u>10.3</u>	<u>17.3</u>	<u>9.1</u>	<u>19</u>	_____	_____
<u>10.2</u>	<u>20.2</u>	<u>10.3</u>	<u>20.8</u>	_____	_____
<u>10.3</u>	<u>20.8</u>	<u>9.3</u>	<u>22</u>	_____	_____
<u>10.6</u>	<u>20.9</u>	<u>10.0</u>	<u>17.3</u>	_____	_____
Time (clock): <u>1625</u>		Room Temperature (F): <u>78</u>		Initials: <u>RT</u>	

Technician Signature: B/A K.P. Meyer

Date: 9/27/23

**ASTM E2780 Wood Heater Run Sheets**

Client: MF Fire \_\_\_\_\_ Project Number: 0552WS003E \_\_\_\_\_ Run Number: 3 \_\_\_\_\_  
 Model: Nova C \_\_\_\_\_ Tracking Number: 2468 \_\_\_\_\_ Date: 7/12/2023 \_\_\_\_\_  
 Test Crew: RT \_\_\_\_\_  
 OMNI Equipment ID numbers: \_\_\_\_\_

**ASTM E2515 Lab Sheet**

Assembled By:

Riley Tieg

Date/Time in Dessicator:

2045 7/12/2023

Weighing #1	Weighing #2	Weighing #3	Weighing #4	Weighing #5
Date/Time: 7-13-2023	Date/Time: 7-17-2023	Date/Time: 7-19-2023	Date/Time: 7-24-2023	Date/Time: 7-27-23
R/H %: 17.1	R/H %: 16.4	R/H %: 17.1	R/H %: 10.7	R/H %: 7.9
Temp: 76.4	Temp: 77.5	Temp: 77.8	Temp: 78.0	Temp: 77.3
200 mg Audit: 200.1	200 mg Audit: 200.1	200 mg Audit: 200.1	200 mg Audit: 199.9	200 mg Audit: 200.1
2 g Audit: 2000.3	2 g Audit: 2000.5	2 g Audit: 2000.3	2 g Audit: 2000.1	2 g Audit: 2000.2
100 g Audit: 99997.9	100 g Audit: 99997.9	100 g Audit: 99997.8	100 g Audit: 99997.8	100 g Audit: 99997.8
Initials: RT	Initials: RT	Initials: RT	Initials: RT	Initials: RT

0807-23  
9.8  
77.8  
200.1  
2000.1  
99997.8  
RT

Train	Element	ID #	Tare (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)
A (First Hour)	Front Filter	F001	118.1 ✓	122.1 122.4	122.1 ✓			
	Rear Filter	F003	118.3 ✓	118.5	118.4 ✓			
	Probe	75	117637.9 ✓	117638.1	117638.0 ✓			
	O-Ring Set	5531	3435.2 ✓	3436.6	3436.6 ✓	3435.9	3435.8 ✓	
A (Remainder)	Front Filter	E997	118.5 ✓	122.5	122.3 ✓			
	Rear Filter	E998	118.1 ✓	118.2	118.1 ✓			
	Probe	0855	113570.2 ✓	113570.5	113570.5 ✓			
CLARIFICATION ON ID# 5532 P 16	O-Ring Set	5531 5532	3380.8 ✓ 3435.2 ✓ 3381.0 ✓	3383.0	3382.6	3381.9	3381.3	3381.0 ✓
B	Front Filter	E999	118.2 ✓	122.2	122.1 ✓			
	Rear Filter	F000	117.6 ✓	117.8	117.7 ✓			
	Probe	0856	113710.0 ✓	113710.2	113710.2 ✓			
	O-Ring Set	5533	3362.8 ✓	3364.5	3364.2	3363.6	3362.8	3362.8 ✓
BG	Filter	F004	118.2 ✓	118.4	118.4 ✓			

Technician Signature: Riley Tieg

Date: 9-17-23

## Run 4 Test Data

# Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire  
 Model: Nova C  
 Project No.: 0552WS003E  
 Tracking No.: 2468  
 Run: 4  
 Test Date: 07/13/23

Technician Signature: \_\_\_\_\_

	<b>2.28 kg/hr dry</b>
Average Tunnel Temperature	127 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	22.94 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	14388.0 dscf/hour
Average Delta p	0.109 inches H2O
Total Time of Test	123 minutes

	AMBIENT		SAMPLE TRAIN 1		SAMPLE TRAIN 2		FIRST HOUR FILTER (TRAIN 1)	
	18.836 cubic feet 85 degrees Fahrenheit 18.584 dscf	0 mg 0.000000 grams/dscf 0.00 grams 0.00 grams/hour	19.523 cubic feet 92 degrees Fahrenheit 18.979 dscf	6.8 mg 0.00036 grams/dscf 10.57 grams 5.16 grams/hour 2.26 g/kg	19.931 cubic feet 93 degrees Fahrenheit 19.490 dscf	7.4 mg 0.00038 grams/dscf 11.20 grams 5.46 grams/hour 2.39 g/kg	9.515 cubic feet 89 degrees Fahrenheit 9.304 dscf	0 mg 0.00000 grams/dscf 0.00 grams 0.00 grams/hour 0.00 g/kg
Difference from Average Total Particulate Emissions								
<b>Final Average Results</b>								
<b>Complete Test Run</b>								
Total Particulate Emissions - E <sub>T</sub>	10.88	grams					84	Train 1
Particulate Emission Rate	<b>5.31</b>	<b>grams/hour</b>					8.73	Train 2
Emissions Factor	2.33	grams/kg					65	Complies?
							71	OK
<b>First Hour Emissions</b>								
Total Particulate Emissions - E <sub>T</sub>	0.00	grams					0	OK
Particulate Emission Rate	0.00	grams/hour					0.000	OK
Emissions Factor	0.00	grams/kg					0	OK
7.5% of Average Total Particulate Emissions	0.82	grams					0	OK
							84	OK
							87	OK
							2.9%	OK
							0.13	OK
							27	OK
							10	OK

## Wood Heater Test Fuel Data - ASTM E2780

Manufacturer : MF Fire  
 Model : Nova C  
 Tracking No. : 2468  
 Project No. : 0552WS003E  
 Test Date : 7/13/2023  
 Run No. : 4

Moisture Meter Cal	
Cal Block	Measured
12.0	12.0
22.0	22.0

Firebox Volume : 1.70 ft<sup>3</sup>  
 % 2 x 4 Required : 35 - 65 %  
 Ideal Fuel Weight : 11.9 lb.  
 Minimum Fuel Weight : 10.71 lb.  
 Maximum Fuel Weight : 13.09 lb.

Fuel Piece Data										Wet Weights, lb		Dry Weights, lb	
PC #	Weight, lb	Size	Length, In	Moisture Readings, Dry Basis %			Average MC, % db	Dry Weight, lb.	Volume, ft <sup>3</sup>	4 x 4		2 x 4	
										4 x 4	2 x 4	4 x 4	2 x 4
1	1.40	2x4	14.00	20.4	24.2	23.8	22.8	1.14	0.0425		1.4		1.14
2	1.50	2x4	14.00	19.4	19.3	19.3	19.3	1.26	0.0425		1.5		1.26
3	1.60	2x4	14.00	21.1	19.2	19.8	20.0	1.33	0.0425		1.6		1.33
4	2.80	4x4	14.00	19.1	22.0	24.7	21.9	2.30	0.0992	2.8		2.30	
5	3.30	4x4	14.00	24.3	20.2	18.8	21.1	2.73	0.0992	3.3		2.73	
6													
7													
8													
9													

Spacer Data										
Moisture Readings, Dry Basis % (One reading per spacer)										
				17.4	10.6	13.5	15.8			
				18.1	17.1	10.2	17.2			
				12.5	15.1	15.6	13.0			
				15.2	15.2	17.5	20.0			
Avg : 15.3										

Assembled Crib Fuel Load with Spacers Attached										
PC #	Weight, lb with Spacers	Size	4 x 4s	2 x 4s						
					1	1.90	2x4		1.9000	
2	1.90	2x4		1.9000						
3	2.00	2x4		2.0000						
4	3.10	4x4	3.10							
5	3.50	4x4	3.50							
6										
7										
8										
9										
					Combined Mass of 4 x 4s	6.6	lb			
					Combined Mass of 2 x 4s	5.8	lb			
					Total Wet Mass of Fuel Load	12.4	lb			

Fuel Load Properties									
Type	Number of Pieces	Wet Weight, lb.	Dry Weight, lb.	Fuel Loading Density, lb/ft <sup>3</sup>		Dry Fuel Density, lb/ft <sup>3</sup>	Wet Fuel Density, lb/ft <sup>3</sup>	Moisture, %	
				Wet Basis	Dry Basis			Dry Basis	Wet Basis
2 x 4	3	4.5	3.73	7.29	6.07	26.84	32.51	20.23	16.83
4 x 4	2	6.1	5.02						
Spacers	16	1.8	1.56						
Totals		12.4	10.31						

Compliance Checks					
	Fuel Load, Wet Lb.	Load Density, lb/ft <sup>3</sup> of FB vol	Fuel Density, lb/ft <sup>3</sup>	% of Fuel load mass which is 2x4	Fuel Load Peices Mositure, % db
Measured	12.4	7.29	26.84	47	21.0
Required	10.7 - 13.1	6.3 - 7.7	25 - 36	35 - 65	19 -25
Complies ?	Yes	Yes	Yes	Yes	Yes

## Wood Heater Preburn Data - ASTM E2780

**Run: 4**

Technician Signature \_\_\_\_\_

Manufacturer: MF Fire  
 Model: Nova C  
 Tracking No.: 2468  
 Project No.: 0552WS003E  
 Test Date: 7/13/23

Beginning Clock Time: \_\_\_\_\_

Preburn Fuel Data					
_____	1	pieces @ _____	144	inches	
_____	pieces @ _____	inches			
_____	pieces @ _____	inches			
Fuel Moisture Readings (% DB):					
		23.3			
		21			
		24			
Avg Preburn Moisture (% DB): <b>22.77</b>					

Coal Bed	<b>2.5</b>	<b>3.1</b>
Range (lb):	(min)	(max)

Elapsed Time (min)	Scale (lb)	Stack Draft (in H <sub>2</sub> O)	Temperatures (°F)								
			FB Top	FB Bottom	FB Back	FB Left	FB Right	Cat Exit	Avg. FB	Stack	Ambient
0	5.3	-0.066	441	154	315	289	242	781	288.2	517	81
1	11.7	-0.067	439	155	322	295	244	864	291	473	80
1	11.7	-0.066	440	155	322	295	244	864	291.4	472	80
2	11.5	-0.067	443	157	326	300	247	967	294.6	473	80
2	11.5	-0.067	442	157	326	300	247	984	294.5	473	80
3	11.4	-0.066	446	158	328	305	250	945	297.2	468	80
3	11.4	-0.066	444	158	327	305	249	959	296.8	467	80
4	11.3	-0.067	444	160	327	309	252	957	298.5	467	80
4	11.3	-0.066	444	160	327	309	252	979	298.5	467	80
5	11.2	-0.066	446	161	326	313	255	940	300.1	464	81
5	11.2	-0.066	448	161	326	313	255	952	300.6	464	81
6	11.1	-0.066	449	163	324	316	257	929	301.6	462	81
6	11.1	-0.066	450	163	324	316	257	951	301.9	462	81
7	11	-0.066	449	165	321	318	258	955	302.4	461	81
7	11	-0.066	449	165	321	318	258	937	302.4	461	81
8	10.8	-0.066	453	166	319	321	260	953	303.9	461	80
8	10.8	-0.066	453	166	319	321	260	945	303.9	461	80
9	10.4	-0.066	452	168	317	322	261	918	304.2	454	80
9	10.4	-0.066	452	168	317	322	261	942	304.1	454	80
10	10.2	-0.066	453	170	315	323	262	958	304.7	448	81
10	10.2	-0.066	454	170	315	323	262	958	304.8	448	81
11	10.3	-0.068	468	172	314	325	263	1018	308.3	456	81
11	10.3	-0.068	469	172	314	325	263	999	308.4	457	81
12	10.2	-0.069	495	173	313	326	263	1120	314.2	474	81
12	10.2	-0.069	497	173	313	326	264	1135	314.7	474	81
13	10	-0.069	527	175	312	327	265	1109	321.1	482	80
13	10	-0.069	527	175	312	326	265	1127	321.1	482	80
14	9.8	-0.07	546	177	310	327	267	1103	325.2	486	81
14	9.8	-0.07	547	177	310	326	267	1118	325.3	486	81
15	9.6	-0.07	567	179	309	327	268	1121	330	491	80
15	9.6	-0.07	567	179	309	327	268	1140	330	491	80
16	9.5	-0.071	579	181	308	326	270	1172	332.6	496	81
16	9.4	-0.071	579	181	308	326	269	1150	332.6	496	81
17	9.3	-0.072	600	183	307	326	271	1139	337.4	500	81
17	9.3	-0.071	602	183	307	326	271	1149	337.8	500	80
18	9.1	-0.071	605	185	307	327	273	1154	339.2	501	81
18	9.1	-0.07	606	185	307	327	273	1153	339.3	502	81
19	8.9	-0.071	621	186	306	327	274	1145	343	504	81
19	8.9	-0.071	621	187	306	327	274	1145	343	504	81
20	8.7	-0.071	639	188	306	327	276	1204	347.4	508	81
20	8.7	-0.071	638	188	306	327	276	1177	347.2	508	81
21	8.5	-0.071	649	190	307	328	278	1204	350.3	509	81
21	8.5	-0.071	647	190	307	328	278	1183	350	509	81

## Wood Heater Preburn Data - ASTM E2780

**Run: 4**

Technician Signature \_\_\_\_\_

Manufacturer: MF Fire  
 Model: Nova C  
 Tracking No.: 2468  
 Project No.: 0552WS003E  
 Test Date: 7/13/23

Beginning Clock Time: \_\_\_\_\_

Preburn Fuel Data					
	1 pieces @	144	inches		
	pieces @		inches		
	pieces @		inches		
Fuel Moisture Readings (% DB):					
		23.3			
		21			
		24			
Avg Preburn Moisture (% DB): <b>22.77</b>					

Coal Bed	<b>2.5</b>	<b>3.1</b>
Range (lb):	(min)	(max)

Elapsed Time (min)	Scale (lb)	Stack Draft (in H <sub>2</sub> O)	Temperatures (°F)								
			FB Top	FB Bottom	FB Back	FB Left	FB Right	Cat Exit	Avg. FB	Stack	Ambient
22	8.3	-0.071	651	192	307	328	280	1149	351.9	508	81
22	8.3	-0.071	653	192	307	328	280	1176	352.1	508	81
23	8.2	-0.071	658	194	308	329	283	1142	354.4	508	81
23	8.2	-0.07	657	194	308	329	283	1162	354.3	508	81
24	8	-0.072	660	196	308	330	285	1166	355.8	510	82
24	8	-0.071	662	196	308	330	285	1166	356.3	510	82
25	7.8	-0.07	664	198	309	332	288	1160	358.1	508	81
25	7.8	-0.07	664	198	309	332	288	1145	358.1	508	81
26	7.7	-0.07	669	200	310	333	290	1126	360.5	507	81
26	7.7	-0.07	667	200	310	333	290	1118	360	507	81
27	7.5	-0.07	668	201	311	335	293	1130	361.7	508	82
27	7.5	-0.071	668	201	311	335	292	1152	361.7	508	82
28	7.3	-0.07	673	203	313	337	295	1163	364.2	510	81
28	7.3	-0.07	670	203	313	337	295	1163	363.5	510	81
29	7.1	-0.071	677	205	315	339	298	1158	366.7	512	81
29	7.1	-0.071	678	205	315	339	298	1164	366.8	512	81
30	7	-0.071	680	206	317	341	301	1143	369	513	82
30	7	-0.071	678	206	317	341	301	1144	368.6	513	82
31	6.8	-0.07	685	208	319	344	304	1176	372	515	82
31	6.8	-0.07	684	208	319	344	304	1152	372	515	82
32	6.6	-0.07	686	210	322	347	307	1183	374.4	516	83
32	6.6	-0.071	687	210	322	347	307	1183	374.6	516	83
33	6.5	-0.071	695	212	324	350	310	1212	378.3	518	82
33	6.5	-0.071	695	212	324	350	310	1180	378.2	518	82
34	6.3	-0.071	700	214	327	353	313	1198	381.3	521	82
34	6.3	-0.071	700	214	327	353	314	1186	381.5	521	82
35	6.1	-0.071	710	216	329	356	316	1224	385.3	522	82
35	6.1	-0.071	708	216	329	356	316	1195	385	522	82
36	5.9	-0.071	714	217	332	359	319	1211	388.3	520	82
36	5.9	-0.071	713	217	332	359	319	1231	388.2	520	82
37	5.8	-0.07	722	219	336	362	323	1201	392.4	520	83
37	5.8	-0.07	720	219	336	362	323	1225	392	520	83
38	5.6	-0.07	720	221	339	366	326	1225	394.2	521	81
38	5.6	-0.071	720	221	339	366	326	1241	394.2	521	81
39	5.4	-0.071	726	223	342	369	329	1195	397.8	523	82
39	5.4	-0.071	727	223	342	369	330	1205	397.9	523	82
40	5.3	-0.072	731	224	345	372	332	1226	400.8	525	83
40	5.3	-0.072	732	224	345	372	333	1231	401.1	525	83
41	5.1	-0.07	738	226	348	375	336	1203	404.6	528	83
41	5.1	-0.071	737	226	348	375	336	1203	404.6	528	83
42	5	-0.071	742	228	352	379	339	1220	407.8	530	83
42	5	-0.071	743	228	352	379	339	1205	408	530	83
43	4.8	-0.071	746	229	355	383	342	1205	411.2	532	83



## Wood Heater Preburn Data - ASTM E2780

**Run: 4**

Technician Signature \_\_\_\_\_

Manufacturer: MF Fire  
 Model: Nova C  
 Tracking No.: 2468  
 Project No.: 0552WS003E  
 Test Date: 7/13/23

Beginning Clock Time: \_\_\_\_\_

Preburn Fuel Data					
_____	1	pieces @ _____	144	inches	
_____	_____	pieces @ _____	_____	inches	
_____	_____	pieces @ _____	_____	inches	
Fuel Moisture Readings (% DB):					
		23.3			
		21			
		24			
Avg Preburn Moisture (% DB): <b>22.77</b>					

Coal Bed	<b>2.5</b>	<b>3.1</b>
Range (lb):	(min)	(max)

Elapsed Time (min)	Scale (lb)	Stack Draft (in H <sub>2</sub> O)	Temperatures (°F)								
			FB Top	FB Bottom	FB Back	FB Left	FB Right	Cat Exit	Avg. FB	Stack	Ambient
43	4.8	-0.07	751	229	355	383	342	1203	412.1	532	83
44	4.7	-0.071	750	231	359	386	345	1233	414.2	533	84
44	4.6	-0.071	747	231	359	386	345	1232	413.7	533	84
45	4.5	-0.071	754	232	363	390	349	1208	417.7	531	82
45	4.5	-0.071	754	232	363	390	349	1201	417.6	531	82
46	4.4	-0.07	761	234	367	394	352	1183	421.5	531	83
46	4.4	-0.07	761	234	367	394	352	1171	421.4	531	83
47	4.3	-0.071	754	235	371	397	355	1156	422.3	530	84
47	4.3	-0.071	754	235	371	397	355	1161	422.3	530	83
48	4.1	-0.07	755	237	375	401	358	1191	425	529	83
48	4.1	-0.07	755	237	375	401	358	1168	425.2	529	83
49	4	-0.07	753	239	379	405	361	1197	427.5	529	84
49	4	-0.071	754	239	379	405	362	1181	427.7	530	84
50	3.9	-0.069	752	241	383	408	365	1209	429.7	528	83
50	3.9	-0.07	753	241	383	408	365	1209	430.1	528	83
51	3.8	-0.07	747	242	388	412	367	1214	431.1	528	82
51	3.8	-0.071	747	242	388	412	367	1180	431.1	528	83
52	3.7	-0.07	740	243	393	415	369	1156	432.2	526	83
52	3.7	-0.07	740	243	393	415	369	1158	432.1	526	83
53	3.6	-0.07	741	245	397	418	373	1149	434.9	525	84
53	3.6	-0.07	739	245	397	418	373	1179	434.5	525	84
54	3.5	-0.07	733	247	402	422	375	1147	435.6	522	83
54	3.5	-0.07	733	247	402	422	375	1124	435.8	522	84
55	3.4	-0.069	723	248	407	425	377	1138	436	518	84
55	3.4	-0.069	724	248	407	425	377	1120	436.3	518	84
56	3.3	-0.068	723	250	412	428	380	1133	438.6	516	84
56	3.3	-0.068	723	250	412	428	380	1150	438.7	516	84
57	3.2	-0.068	714	252	417	431	382	1140	439.2	513	83
57	3.2	-0.067	712	252	417	431	383	1124	439.1	513	83
58	3.1	-0.069	702	253	423	433	384	1065	439	510	82
58	3.1	-0.068	699	253	423	433	384	1090	438.5	510	82
59	3.1	-0.068	694	255	429	435	386	1072	439.8	507	84
59	3.1	-0.068	694	255	429	435	386	1072	439.8	507	84
60	3	-0.066	681	257	435	438	388	1069	439.7	503	83
60	3	-0.067	682	257	435	438	388	1069	439.9	503	83
61	2.9	-0.066	678	258	440	439	390	1063	441.2	500	85
61	2.9	-0.066	679	258	440	440	390	1062	441.3	500	85
62	2.9	-0.067	667	260	445	441	392	1045	441	498	85
62	2.9	-0.067	667	260	445	441	392	1022	441.1	498	85
63	2.8	-0.066	659	262	450	442	393	1032	441.2	495	84
63	2.8	-0.066	661	262	450	442	393	1045	441.5	495	84
64	2.8	-0.066	653	263	455	443	393	1016	441.5	489	84
64	2.8	-0.066	651	263	455	443	394	1016	441.4	489	84

## Wood Heater Preburn Data - ASTM E2780

**Run: 4**

Technician Signature \_\_\_\_\_

Manufacturer: MF Fire  
 Model: Nova C  
 Tracking No.: 2468  
 Project No.: 0552WS003E  
 Test Date: 7/13/23

Beginning Clock Time: \_\_\_\_\_

Preburn Fuel Data					
	1 pieces @	144 inches			
	pieces @	inches			
	pieces @	inches			
Fuel Moisture Readings (% DB):					
		23.3			
		21			
		24			
Avg Preburn Moisture (% DB): <b>22.77</b>					

Coal Bed	<b>2.5</b>	<b>3.1</b>
Range (lb):	(min)	(max)

Temperatures (°F)											
Elapsed Time (min)	Scale (lb)	Stack Draft (in H <sub>2</sub> O)	FB Top	FB Bottom	FB Back	FB Left	FB Right	Cat Exit	Avg. FB	Stack	Ambient
65	2.7	-0.065	648	265	459	443	396	963	442	484	84
65	2.7	-0.065	648	265	459	443	396	985	442	484	84
66	2.7	-0.064	642	267	463	444	397	961	442.3	480	85
66	2.7	-0.064	641	267	463	444	397	959	442.3	480	85



Run: 4
Manufacturer: MF Fire
Model: Nova C
Tracking No.: 2483
Project No.: 192716300E
Start Date: 12/1/19
Beginning Clock Time: 13:05

Total Sampling Time: 123 min
Recording Interval: 6 min
Test Sample Volume: 18,836 cubic feet
Background Sample Volume: 18,836 cubic feet

PM Control Modules: 335,338
Dilution Tunnel MM(dry): 29.00
Dilution Tunnel MM(wet): 29.79
Dilution Tunnel Size: 2.00
Tunnel Area: 0.14835 sq ft
Pilot Tube Cp: 0.59

Avg. Tunnel Velocity: 22.94 ft/sec
Initial Tunnel Flow: 230.3 scfm
Avg. Range Channel Length: 239.8 ft
Post-Test Leak Check (1): 0.001 cfm @ 18 in. Hg
Post-Test Leak Check (2): 0.003 cfm @ 17 in. Hg
Average Test Piece Fuel Moisture: 20.23 %

PM Control Modules: 335,338
Dilution Tunnel MM(dry): 29.00
Dilution Tunnel MM(wet): 29.79
Dilution Tunnel Size: 2.00
Tunnel Area: 0.14835 sq ft
Pilot Tube Cp: 0.59

Avg. Tunnel Velocity: 22.94 ft/sec
Initial Tunnel Flow: 230.3 scfm
Avg. Range Channel Length: 239.8 ft
Post-Test Leak Check (1): 0.001 cfm @ 18 in. Hg
Post-Test Leak Check (2): 0.003 cfm @ 17 in. Hg
Average Test Piece Fuel Moisture: 20.23 %

Avg. Tunnel Velocity: 22.94 ft/sec
Initial Tunnel Flow: 230.3 scfm
Avg. Range Channel Length: 239.8 ft
Post-Test Leak Check (1): 0.001 cfm @ 18 in. Hg
Post-Test Leak Check (2): 0.003 cfm @ 17 in. Hg
Average Test Piece Fuel Moisture: 20.23 %

Wood Heater Test Data

Table with columns: Pt.1, Pt.2, Pt.3, Pt.4, Pt.5, Pt.6, Pt.7, Pt.8, Center. Rows: Initial dp, Temp.

Velocity Traverse Data
Pt.1 Pt.2 Pt.3 Pt.4 Pt.5 Pt.6 Pt.7 Pt.8 Center
Initial dp 0.110 0.112 0.110 0.108 0.104 0.110 0.110 0.108 0.110
Temp: 127 127 128 128 128 128 128 128 124

Velocity Traverse Data
Pt.1 Pt.2 Pt.3 Pt.4 Pt.5 Pt.6 Pt.7 Pt.8 Center
Initial dp 0.110 0.112 0.110 0.108 0.104 0.110 0.110 0.108 0.110
Temp: 127 127 128 128 128 128 128 128 124

Velocity Traverse Data
Pt.1 Pt.2 Pt.3 Pt.4 Pt.5 Pt.6 Pt.7 Pt.8 Center
Initial dp 0.110 0.112 0.110 0.108 0.104 0.110 0.110 0.108 0.110
Temp: 127 127 128 128 128 128 128 128 124

Export to PDF

OMNI Equipment Numbers table with columns: Meter Box Y Factor, End, Average, Room Air Velocity, etc.

Main test data table with columns: Elapsed Time, Gas Meter 1, Gas Meter 2, Particulate Sampling Data (Orifice, Meter 1, Meter 2, Vacuum, Temp), Dilution Tunnel, Fuel Weight, Pro. Rate, Firebox, and Stack Gas Data (Ambient, Driver, Filter, Catalyst, Stack, Avg. Sove Surface).

Run: 4

Manufacturer: MF Fire
Model: Nova C
Tracking No.: 2483
Project No.: 130716500E
Test Date: 12/11/2013
Beginning Clock Time: 13:05

Total Sampling Time: 123 min
Recording Interval: 6 min
Total Sample Volume: 18,836 cubic feet
Background Sample Volume: 18,836 cubic feet

PM Control Modules: 335,338
Dilution Tunnel MM(dry): 29.00
Dilution Tunnel MM(wet): 28.78
Dilution Tunnel MM(wet): 28.78
Dilution Tunnel MM(wet): 28.78
Tunnel Area: 0.14835 sq ft
Plot Tube Cp: 0.59

Avg. Tunnel Velocity: 22.94 ft/sec
Initial Tunnel Flow: 230.33 scfm
Avg. Tunnel Velocity: 22.94 ft/sec
Initial Tunnel Flow: 230.33 scfm
Post-Test Average Channel Hg: 0.003466 @ 18 in. Hg
Post-Test Leak Check (1): 0.003466 @ 17 in. Hg
Post-Test Leak Check (2): 0.003466 @ 17 in. Hg
Average Test Piece Fuel Moisture: 20.23 % Dry Basis %

Technician Signature:

Export to PDF

Table with 5 columns: Meter Box Y Factor, Biometric Pressure, Room Air Velocity, and other parameters.

Velocity Traverse Data table with columns for various ports (P1.1 to P1.8) and flow rates.

Flow rate and velocity information: V\_sam = 23.04 f/sec, F\_p = 0.898 cfm

Main data table with 16 columns: Elapsed Time (min), Gas Meter 1 (ft³), Gas Meter 2 (ft³), Particulate Sampling Data (Orifice dH1, dH2, Vacuum, Temp), Dilution Tunnel Center dp, Fuel Weight Change, Temperature Data (Avg. Stove Surface, Firebox Left/Right/Bottom/Top, Catalyst Exit, Stack), Filter 1/2, Driver Exit 1/2, Ambient, and Stack Gas Data (Draift, CO₂, CO).

# Wood Heater Test Data

**Run:** 4  
 Manufacturer: MF Fire  
 Model: Nova C  
 Tracking No.: 2483  
 Project No.: 19276500E  
 Test Date: 10/23/2019  
 Beginning Clock Time: 13:05

Total Sampling Time: 123 min  
 Recording Interval: 6 min  
 Total Sample Volume: 18,836 cubic feet  
 Background Sample Volume: 18,836 cubic feet

PM Control Modules: 335,338  
 Dilution Tunnel MM(dry): 29.00  
 Dilution Tunnel MM(wet): 28.73  
 Dilution Tunnel SDC: 2.00  
 Tunnel Area: 0.15835 ft<sup>2</sup>  
 Pilot Tube Cp: 0.59

Avg. Tunnel Velocity: 22.94 ft/sec.  
 Initial Tunnel Flow: 240.33 scfm  
 Average Chamber Flow: 239.8 scfm  
 Post-Test Leak Check (1): 0.003 cfm @ 18 in. Hg  
 Post-Test Leak Check (2): 0.003 cfm @ 17 in. Hg  
 Average Test Piece Fuel Moisture: 20.23 Dry Basis %

Avg. Tunnel Velocity: 22.94 ft/sec.  
 Initial Tunnel Flow: 240.33 scfm  
 Average Chamber Flow: 239.8 scfm  
 Post-Test Leak Check (1): 0.003 cfm @ 18 in. Hg  
 Post-Test Leak Check (2): 0.003 cfm @ 17 in. Hg  
 Average Test Piece Fuel Moisture: 20.23 Dry Basis %

Technician Signature: \_\_\_\_\_  
 Date: \_\_\_\_\_

Velocity Traverse Data								
PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8	Center
Initial dp	0.110	0.112	0.110	0.108	0.104	0.110	0.108	0.110
Temp:	127	127	128	128	128	128	128	124

V<sub>ave</sub> 22.99 ft/sec      V<sub>cent</sub> 23.04 ft/sec      q<sub>w</sub> 0.898

Fuel Weight (lb)	
Scale	Weight Change
Pro. Rate 1	99
Pro. Rate 2	100

Temperature Data (F)								
Stack	Catalyst Exit	Avg. Stove Surface (Tot = At)	Firebox Right	Firebox Left	Firebox Bottom	Firebox Top	Firebox Back	Firebox Front
848	415	432	403	457	467	522	310	467
86	86	86	86	86	86	86	86	86

Particulate Sampling Data																
Elapsed Time (min)	Gas Meter 1 (ft <sup>3</sup> )	Gas Meter 2 (ft <sup>3</sup> )	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH1 (H <sub>2</sub> O)	Orifice dH2 (H <sub>2</sub> O)	Meter 1 Vacuum (inHg)	Meter 2 Vacuum (inHg)	Dilution Tunnel (F)	Dilution Tunnel Center dp	Pro. Rate 1	Pro. Rate 2	Scale	Weight Change		
99	15.704	15.979	0.16	0.16	1.20	96	2.43	0.99	97	2.1	118	0.108	99	100	0.8	0
100	15.864	16.144	0.16	0.16	1.19	96	2.43	0.98	97	2	118	0.108	101	102	0.7	-0.1
101	16.023	16.309	0.16	0.17	1.19	96	2.43	0.98	97	2	118	0.110	98	100	0.7	0
102	16.181	16.474	0.16	0.16	1.19	96	2.44	0.98	97	2	118	0.107	99	101	0.7	0
103	16.340	16.638	0.16	0.16	1.19	96	2.43	0.98	97	2	118	0.106	100	101	0.6	-0.1
104	16.500	16.803	0.16	0.16	1.19	96	2.44	0.98	97	2	118	0.107	100	101	0.6	0
105	16.659	16.967	0.16	0.16	1.19	96	2.43	0.99	97	2.1	117	0.107	99	100	0.7	0.1
106	16.817	17.131	0.16	0.16	1.19	96	2.44	0.98	97	2.1	117	0.110	98	99	0.5	-0.2
107	16.976	17.296	0.16	0.16	1.19	96	2.43	0.98	97	2.1	117	0.109	99	100	0.6	0.1
108	17.137	17.461	0.16	0.16	1.18	96	2.44	0.99	97	2.1	117	0.106	101	102	0.5	-0.1
109	17.295	17.626	0.16	0.17	1.19	96	2.43	0.99	97	2	117	0.108	98	101	0.5	0
110	17.454	17.791	0.16	0.16	1.19	96	2.43	0.98	97	2	117	0.110	98	100	0.4	-0.1
111	17.613	17.956	0.16	0.16	1.19	96	2.43	0.98	97	2.1	117	0.107	99	101	0.4	0
112	17.773	18.120	0.16	0.16	1.20	96	2.44	0.99	97	2.1	117	0.106	101	101	0.4	0
113	17.932	18.284	0.16	0.16	1.19	96	2.43	0.98	97	2	117	0.108	99	100	0.5	0.1
114	18.090	18.449	0.16	0.17	1.20	96	2.43	0.99	97	2	117	0.107	99	101	0.3	-0.2
115	18.249	18.614	0.16	0.16	1.20	96	2.43	0.99	97	2	116	0.109	98	100	0.4	0.1
116	18.409	18.779	0.16	0.16	1.20	96	2.43	0.99	97	2.1	116	0.107	100	101	0.3	-0.1
117	18.568	18.944	0.16	0.16	1.19	96	2.43	0.99	97	2	116	0.111	98	99	0.2	-0.1
118	18.727	19.108	0.16	0.16	1.20	96	2.43	0.98	97	2	116	0.111	98	98	0.2	0
119	18.886	19.273	0.16	0.16	1.19	96	2.43	0.98	97	2	116	0.107	99	101	0.2	0
120	19.046	19.437	0.16	0.16	1.19	96	2.43	0.99	97	2.1	116	0.108	101	101	0.2	0
121	19.205	19.602	0.16	0.16	1.19	96	2.43	0.99	97	2	116	0.108	99	101	0.1	-0.1
122	19.363	19.767	0.16	0.16	1.20	96	2.43	0.99	97	2	116	0.107	99	101	0.1	0
123	19.523	19.931	0.16	0.16	1.20	96	2.43	0.99	97	2.1	116	0.107	100	100	0.0	-0.1

Biometric Pressure			
Begin	Middle	End	Average
30.14	30.14	30.14	30.14

Stack Gas Data						
Elapsed Time (min)	Driver Exit 1	Driver Exit 2	Ambient	CO (%)	CO <sub>2</sub> (%)	Draft (H <sub>2</sub> O)
99	82	71	83	54	86	-0.060
100	82	71	83	54	86	-0.060
101	82	71	83	54	86	-0.060
102	82	71	83	54	86	-0.060
103	82	71	83	54	86	-0.060
104	82	71	83	54	86	-0.060
105	82	62	83	54	85	-0.059
106	82	58	83	54	85	-0.060
107	82	56	83	54	86	-0.059
108	82	55	83	54	86	-0.060
109	82	55	83	54	85	-0.059
110	82	54	83	54	86	-0.059
111	82	54	83	54	85	-0.059
112	82	54	83	54	86	-0.059
113	82	54	83	54	86	-0.059
114	82	54	83	54	85	-0.059
115	82	54	83	54	86	-0.059
116	82	54	83	54	85	-0.059
117	82	54	83	54	86	-0.059
118	82	54	83	54	85	-0.059
119	82	55	83	54	86	-0.059
120	82	55	83	54	85	-0.058
121	82	55	83	54	85	-0.059
122	82	55	83	54	85	-0.059
123	82	55	83	54	85	-0.058

OMNI Equipment Numbers:								
PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8	Center
0.110	0.112	0.110	0.108	0.104	0.110	0.108	0.110	0.110
127	127	128	128	128	128	128	128	124

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## Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire	Equipment Numbers: _____
Model: Nova C	_____
Tracking No.: 2468	_____
Project No.: 0552WS003E	_____
Run #: 4	_____
Date: 7/13/23	_____

**First Hour**

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

<b>Sub-Total</b>	Total Particulate, mg:	0.0
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**TRAIN 1**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	F007	123.7	117.4	6.3
C. Rear filter catch	Filter	F008	117.2	117.1	0.1
D. Probe catch*	Probe	37	114466.4	114466.2	0.2
E. Filter seals catch*	Seals	5535	3350.5	3350.3	0.2

<b>Sub-Total</b>	Total Particulate, mg:	6.8
------------------	------------------------	-----

**TRAIN 2**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	F009	122.9	116.2	6.7
B. Rear filter catch	Filter	F010	117.5	117.4	0.1
C. Probe catch*	Probe	36	114884.1	114883.9	0.2
D. Filter seals catch*	Seals	5536	4147.8	4147.4	0.4

<b>Total Particulate, mg:</b>	<b>7.4</b>
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**AMBIENT**

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch*	Filter	F011	116.4	116.4	0.0

<b>Total Particulate, mg:</b>	<b>0.0</b>
-------------------------------	------------

\*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: \_\_\_\_\_

## Run 4 First Hour Emissions Data



# Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire  
 Model: Nova C  
 Project No.: 0552WS003E  
 Tracking No.: 2468  
 Run: 4  
 Test Date: 07/13/23

Technician Signature: \_\_\_\_\_

<b>Burn Rate</b>	<b>4.68 kg/hr dry</b>
Average Tunnel Temperature	135 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	23.21 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	14376.9 dscf/hour
Average Delta p	0.110 inches H2O
Total Time of Test	60 minutes

	AMBIENT		SAMPLE TRAIN 1		SAMPLE TRAIN 2		FIRST HOUR FILTER (TRAIN 1)	
Total Sample Volume - Vm	18.836 cubic feet		9.429 cubic feet		0.000 cubic feet		9.429 cubic feet	
Average Gas Meter Temperature	85 degrees Fahrenheit		82 degrees Fahrenheit		#DIV/0! degrees Fahrenheit		82 degrees Fahrenheit	
Total Sample Volume (Standard Conditions) - Vmst	18.587 dscf		9.435 dscf		#DIV/0! dscf		9.435 dscf	
Total Particulates - m <sub>p</sub>	0 mg		0 mg		0 mg		7.1 mg	
Particulate Concentration (dry-standard) - C <sub>p</sub> /C <sub>s</sub>	0.000000 grams/dscf		0.00000 grams/dscf		#DIV/0! grams/dscf		0.00075 grams/dscf	
Total Particulate Emissions - E <sub>T</sub>	0.00 grams		0.00 grams		#DIV/0! grams		10.82 grams	
Particulate Emission Rate	0.00 grams/hour		0.00 grams/hour		#DIV/0! grams/hour		10.82 grams/hour	
Emissions Factor			0.00 g/kg		#DIV/0! g/kg		3.12 g/kg	
Difference from Average Total Particulate Emissions			#DIV/0! grams		#DIV/0! grams			
<b>Final Average Results</b>								
<b>Complete Test Run</b>								
Total Particulate Emissions - E <sub>T</sub>	#DIV/0!	grams	Filter Temps, °F	< 90	First Hour	Train 1	Train 2	Complies?
Particulate Emission Rate	#DIV/0!	grams/hour	Filter Face Velocity, fpm	< 30	84	84	85	OK
Emissions Factor	#DIV/0!	grams/kg	Dryer Exit Temp, °F	< 80	8.73	8.73	0.00	OK
			Leakage Rate, cfm	0.01	66	66	55	OK
			< 4% of avg sample rate or		0.002	0.001	0.002	OK
			< 0.01 cfm, lesser of the two		0.4	0	0	OK
			Neg. Probe Weight	=> 0	0.00%	0.00%	0	OK
<b>First Hour Emissions</b>			Pro-Rate Variation	< 90 for < 10% of θ	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Total Particulate Emissions - E <sub>T</sub>	10.82	grams	# Readings > 80%	> 110 for < 10% of θ	0	0	0	OK
Particulate Emission Rate	10.82	grams/hour	# Readings > 120%		0	0	0	OK
Emissions Factor	3.12	grams/kg	Ambient Temp, °F		0	0	0	OK
7.5% of Average Total Particulate Emissions	#DIV/0!	grams	(min / max)		84	87	84	OK
			Train Precision		#DIV/0!	#DIV/0!	#DIV/0!	OK
			One of A or B must	(A) Within 7.5%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
			Stove Surface ΔT	(B) Within 0.5 g/kg	37	37	37	OK
			Room Air Velocity	Within 125 °F	10	10	10	OK
				< 50 fpm				

Wood Heater Test Data

Run: 4

Manufacturer: MF Fire
Model: Nova C
Tracking No.: 2488
Project No.: 32716500E
Tester: 1305

Total Sampling Time: 60 min
Recording Interval: 6 min
Total Volume: 18.836 cubic feet

PM Control Modules: 335,338
Dilution Tunnel MM(dry): 29.00 Ibb-mole
Dilution Tunnel MM(wet): 28.78 Ibb-mole
Dilution Tunnel SFC: 2.97 g/kg HHV
Dilution Tunnel SFC: 4.17 g/kg HHV
Tunnel Area: 0.14835 ft2
Plot Tube Cp: 0.59

Avg. Tunnel Velocity: 25.21 ft/sec
Initial Tunnel Flow: 280.3 scfm
Avg. Air Flow Rate: 239.0 scfm
Post-Test Leak Check (1): 0.003 cfm @ 15 in. Hg
Post-Test Leak Check (2): 0.003 cfm @ 17 in. Hg

Technician Signature:

Meter Box Y Factor: 1.014 (1) 1.015 (2) 1.012 (Amb)
Biometric Pressure: Begin Middle End Average
30.14 30.14 30.14 30.14

Velocity Traverse Data
P1.1 P1.2 P1.3 P1.4 P1.5 P1.6 P1.7 P1.8 Center
Initial dp 0.110 0.112 0.110 0.108 0.104 0.110 0.110 0.108 0.110 H2O
Temp: 127 127 128 128 128 128 128 128 124 F

Average Test Piece Fuel Moisture: 20.23 Dry Basis %
Fp 0.898

Fuel Weight (lb)
Scale Reading
Weight Change

OMNI Equipment Numbers:

Temperature Data (F)
Avg. Stove Surface (Tot=At)
Firebox Right
Firebox Left
Firebox Back
Firebox Bottom
Firebox Top
Firebox Ext

Stack Gas Data
Draif (H2O)
CO2 (%)
CO (%)

Table with 15 columns: Tor/Avg Time (min), Gas Meter 1 (ft3), Gas Meter 2 (ft3), Sample Rate 1 (cfm), Sample Rate 2 (cfm), Office dh1 (H2O), Office dh2 (H2O), Office Vacuum (Hhg), Meter 1 Vacuum (Hhg), Meter 2 Vacuum (Hhg), Dilution Tunnel Center dp, Pro. Rate Pro. Rate 1, Pro. Rate Pro. Rate 2, Fuel Weight Scale Reading, Weight Change, Firebox Top, Firebox Bottom, Firebox Back, Firebox Left, Firebox Right, Avg. Stove Surface (Tot=At), Stack, Draif Exit 1, Draif Exit 2, Ambient, CO2 (%), CO (%).

# Wood Heater Test Data

Run: **4** Manufacturer: MF Fire  
 Model: Nova C  
 Tracking No.: 2483  
 Project No.: 130716500E  
 Beginning Clock Time: 13:05

Total Sampling Time: 60 min  
 Recording Interval: 6 min  
 Turn Down Time: 0 min  
 Background Sample Volume: 18.836 cubic feet

PM Control Modules: 335.338  
 Dilution Tunnel MM(dry): 29.00 lbb-mole  
 Dilution Tunnel MM(wet): 28.73 lbb-mole  
 Dilution Tunnel SDC: 2.00  
 Dilution Tunnel SDC: 2.00  
 Tunnel Area: 0.14835 ft<sup>2</sup>  
 Pilot Tube Cp: 0.59  
 Avg. Tunnel Velocity: 25.21 ft/sec.  
 Initial Tunnel Flow: 280.3 scfm  
 Average Chamber Flow: 280.3 scfm  
 Post-Test Leak Check (1): 0.003 cfm @ 15 in. Hg  
 Post-Test Leak Check (2): 0.003 cfm @ 18 in. Hg  
 Post-Test Leak Check (3): 0.003 cfm @ 17 in. Hg  
 Average Test Piece Fuel Moisture: 20.23 Dry Basis %

Technician Signature: \_\_\_\_\_

Velocity Traverse Data		Fuel Weight (lb)		Temperature Data (F)				
PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8	Center
Initial dp	0.110	0.112	0.110	0.108	0.104	0.110	0.108	0.110
Temp:	127	127	128	128	128	128	128	124
V <sub>aver</sub>	22.89		ft/sec		23.04		ft/sec	
F <sub>p</sub>	0.898		qwg					

Meter Box Y Factor: 1.014 (1) 1.015 (2) 1.012 (Amb)

Biometric Pressure:		Room Air Velocity (ft/min)	
Begin	Average	End	Average
30.14	30.14	30.14	30.14

OMNI Equipment Numbers:

Elapsed Time (min)	Gas Meter 1 (ft <sup>3</sup> )	Gas Meter 2 (ft <sup>3</sup> )	Particulate Sampling Data				Temperature Data (F)				Stack Gas Data																
			Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH1 (H <sub>2</sub> O)	Meter 1 Temp (°F)	Meter 1 Vacuum (°Hg)	Orifice dH2 (H <sub>2</sub> O)	Meter 2 Temp (°F)	Meter 2 Vacuum (°Hg)	Dilution Tunnel (F)	Dilution Tunnel Center dp	Pro. Rate 1	Pro. Rate 2	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface (Tot=At)	Catalyst Exit	Stack	Filter 1	Filter 2	Driver Exit 2	Ambient
31	4.928	0.16	1.98	82	-2.33	135	0.110	99	6.3	-0.2	847	290	415	453	398	481	1272	555	80	61	80	52	86	-0.076	13.77	1.28	
32	5.083	0.16	2.07	82	-2.43	137	0.114	97	6.1	-0.2	854	289	417	455	399	483	1302	556	80	62	80	52	86	-0.075	13.92	1.56	
33	5.239	0.16	2.03	82	-2.2	136	0.109	100	5.9	-0.2	857	290	420	458	401	485	1347	556	80	62	80	52	87	-0.076	13.97	1.48	
34	5.595	0.16	2.04	82	-2.64	136	0.111	99	5.7	-0.2	863	290	423	460	403	488	1331	557	81	62	80	52	86	-0.076	13.9	1.31	
35	5.548	0.15	2.02	82	-2.22	136	0.111	97	5.5	-0.2	867	290	427	461	404	490	1315	555	81	63	80	52	86	-0.075	13.87	1.09	
36	5.703	0.16	2.00	82	-2.74	135	0.111	98	5.3	-0.2	870	290	431	464	407	492	1284	556	81	63	80	53	84	-0.075	13.71	0.99	
37	5.656	0.15	1.98	82	-2.55	136	0.111	97	5.1	-0.2	869	290	434	466	408	483	1353	556	81	63	80	53	86	-0.075	13.65	0.9	
38	6.008	0.15	1.97	82	-2.66	135	0.110	97	4.9	-0.2	871	290	438	468	410	495	1318	555	81	63	80	53	85	-0.075	13.61	0.84	
39	6.160	0.15	1.95	82	-2.49	135	0.112	96	4.8	-0.1	871	290	442	470	412	497	1303	555	81	64	80	53	87	-0.075	13.54	0.83	
40	6.312	0.15	1.93	82	-2.56	135	0.110	97	4.6	-0.2	871	290	446	472	412	498	1303	554	81	64	81	53	87	-0.074	13.46	0.83	
41	6.465	0.15	2.07	82	-2.48	135	0.110	97	4.4	-0.2	869	290	449	473	414	499	1361	553	81	65	81	53	86	-0.075	13.53	0.86	
42	6.621	0.16	2.07	82	-2.48	135	0.107	101	4.3	-0.1	869	289	453	475	416	500	1329	553	81	65	81	54	87	-0.074	13.35	0.88	
43	6.777	0.16	2.07	82	-2.53	134	0.110	99	4.1	-0.2	866	290	456	477	417	501	1354	553	81	65	81	54	86	-0.075	13.02	0.4	
44	6.934	0.16	2.05	82	-2.48	134	0.107	101	4.0	-0.1	862	290	459	480	418	502	1332	553	81	65	81	54	86	-0.074	12.53	0.15	
45	7.089	0.16	2.06	82	-2.48	134	0.111	98	3.8	-0.2	852	290	462	481	420	501	1326	550	81	66	81	54	86	-0.075	11.97	0.07	
46	7.246	0.16	2.05	83	-2.52	134	0.110	100	3.7	-0.1	844	290	464	484	421	501	1258	548	81	66	81	54	86	-0.073	11.67	0.04	
47	7.402	0.16	2.07	83	-2.9	133	0.111	98	3.6	-0.1	837	290	467	485	422	500	1268	545	81	66	81	54	85	-0.074	11.28	0.03	
48	7.558	0.16	2.06	83	-2.48	133	0.107	100	3.5	-0.1	829	290	470	487	424	500	1204	542	81	66	81	54	86	-0.072	10.81	0.02	
49	7.715	0.16	2.06	83	-3.01	133	0.107	101	3.4	-0.1	818	291	472	489	424	499	1261	538	81	66	81	54	85	-0.073	10.21	0.01	
50	7.871	0.16	2.07	83	-2.55	133	0.111	98	3.3	-0.1	809	291	474	490	425	498	1154	535	81	63	81	55	85	-0.073	9.76	0	
51	8.028	0.16	2.05	83	-2.97	132	0.111	99	3.2	-0.1	797	291	477	492	426	497	1216	528	81	62	81	55	86	-0.071	9.35	0	
52	8.184	0.16	2.08	83	-2.77	131	0.109	99	3.1	-0.1	782	292	479	493	426	494	1162	522	81	61	81	55	85	-0.072	9.02	0	
53	8.340	0.16	2.07	83	-2.57	131	0.109	99	3.0	-0.1	770	292	480	494	427	493	1123	518	81	61	81	55	85	-0.072	8.62	0	
54	8.498	0.16	2.07	83	-2.52	131	0.107	101	2.9	-0.1	758	292	482	494	427	491	1116	514	81	61	81	55	85	-0.071	8.64	0	
55	8.654	0.16	2.08	83	-2.8	130	0.109	99	2.9	-0.1	745	293	483	495	428	489	1138	510	81	61	81	55	85	-0.070	8.56	0	
56	8.811	0.16	2.07	83	-2.75	129	0.107	101	2.8	-0.1	734	293	485	495	429	487	1128	506	81	61	81	55	85	-0.069	8.41	0	
57	8.968	0.16	2.09	83	-2.75	129	0.109	100	2.7	-0.1	723	294	486	496	428	485	1050	502	81	61	81	55	84	-0.069	8.36	0	
58	9.122	0.15	1.95	83	-2.8	128	0.108	98	2.6	-0.1	712	294	487	496	428	483	1046	498	81	62	81	55	84	-0.069	8.37	0	
59	9.275	0.15	1.97	83	-2.85	129	0.108	98	2.6	0	703	294	488	496	428	482	1042	496	81	62	81	55	86	-0.069	8.25	0	
60	9.429	0.15	1.98	83	-2.7	128	0.111	97	2.5	-0.1	695	295	489	495	428	480	1009	492	81	62	81	55	84	-0.069	8.22	0	

## Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire	Equipment Numbers: _____
Model: Nova C	_____
Tracking No.: 2468	_____
Project No.: 0552WS003E	_____
Run #: 4	_____
Date: 7/13/23	_____

**First Hour**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	F005	124.3	118.0	6.3
C. Rear filter catch	Filter	F006	117.4	117.3	0.1
D. Probe catch*	Probe	70	116834.4	116834.0	0.4
E. Filter seals catch*	Seals	5534	3290.5	3290.2	0.3

<b>Sub-Total</b>	Total Particulate, mg:	7.1
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**TRAIN 1**

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

<b>Sub-Total</b>	Total Particulate, mg:	0.0
------------------	------------------------	-----

**TRAIN 2**

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

<b>Total Particulate, mg:</b>	<b>0.0</b>
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**AMBIENT**

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

<b>Total Particulate, mg:</b>	<b>0.0</b>
-------------------------------	------------

\*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: \_\_\_\_\_

# OMNI-Test Laboratories

**Manufacturer:** MF Fire  
**Model:** Nova C  
**Date:** 07/13/23  
**Run:** 4  
**Control #:**  
**Test Duration:** 123  
**Output Category:** SBR

**Technicians:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## Test Results in Accordance with CSA B415.1-10

	HHV Basis	LHV Basis
<b>Overall Efficiency</b>	71.2%	76.9%
<b>Combustion Efficiency</b>	97.6%	97.6%
<b>Heat Transfer Efficiency</b>	73%	78.8%

<b>Output Rate (kJ/h)</b>	32,182	30,528	<b>(Btu/h)</b>
<b>Burn Rate (kg/h)</b>	2.28	5.03	<b>(lb/h)</b>
<b>Input (kJ/h)</b>	45,218	42,894	<b>(Btu/h)</b>

<b>Test Load Weight (dry kg)</b>	4.68	10.31	<b>dry lb</b>
<b>MC wet (%)</b>	16.83		
<b>MC dry (%)</b>	20.24		
<b>Particulate (g)</b>	0		
<b>CO (g)</b>	169		
<b>Test Duration (h)</b>	2.05		

<b>Emissions</b>	<b>Particulate</b>	<b>CO</b>
<b>g/MJ Output</b>	0.00	2.56
<b>g/kg Dry Fuel</b>	0.00	36.10
<b>g/h</b>	0.00	82.40
<b>lb/MM Btu Output</b>	0.00	5.95

<b>Air/Fuel Ratio (A/F)</b>	11.77
-----------------------------	-------

VERSION:

2.4

4/15/2010

VERSION: 2.4 4/15/2010

Manufacturer: MF Fire  
 Model: Nova C  
 Date: 7/13/2023  
 Run: 4  
 Control #:   
 Test Duration: 123  
 Output Category: SBR

Appliance Type: Cat (Cat, Non-Cat, Pellet)

Temp. Units F (F or C)  
 Weight Units lb (kg or lb)

**Default Fuel Values**

	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

Wood Moisture (% wet): 16.83  
 Load Weight (lb wet): 12.40  
 Burn Rate (dry kg/h): 2.28  
 Total Particulate Emissions: g

**Fuel Data**

	D. Fir	
HHV	19,810	kJ/kg
%C	48.73	
%H	6.87	
%O	43.9	
%Ash	0.5	

Note 1: For other fuels, use the heating value and fuel composition determined by analysis of fuel sample in accordance with Clause 9.2.

Averages 0.24 9.24 #DIV/0! 481.15 85.34

Elapsed Time (min)	Fuel Weight Remaining (lb)	Flue Gas Composition (%)			Temp. (°F)	
		CO	CO <sub>2</sub>	O <sub>2</sub>	Flue Gas	Room Temp
0	12.40	0.18	3.01		518.0	85.0
1	12.20	0.19	3.14		468.0	84.0
2	12.10	0.03	5.35		472.0	85.0
3	11.90	0.15	10.51		481.0	86.0
4	11.70	0.02	9.96		488.0	84.0
5	11.60	0.27	10.84		498.0	85.0
6	11.40	0.36	11.27		507.0	84.0
7	11.20	0.26	11.58		514.0	85.0
8	11.00	0.38	12.03		518.0	84.0
9	10.80	0.28	12.05		523.0	84.0
10	10.60	0.08	11.46		524.0	85.0
11	10.40	0.04	10.89		523.0	84.0
12	10.20	0.08	11.18		524.0	85.0
13	10.00	0.19	11.95		526.0	85.0
14	9.80	0.23	12.25		530.0	85.0
15	9.60	0.34	12.72		534.0	85.0
16	9.40	0.43	12.74		535.0	85.0
17	9.20	0.43	12.72		539.0	85.0
18	9.00	0.42	13.13		540.0	86.0
19	8.80	0.71	13.53		544.0	84.0
20	8.60	0.73	13.66		547.0	84.0
21	8.40	0.69	13.62		548.0	85.0
22	8.10	0.84	13.70		550.0	84.0
23	7.90	0.81	13.66		553.0	85.0
24	7.70	0.95	13.79		555.0	85.0
25	7.60	1.06	13.69		556.0	85.0
26	7.30	1.01	13.80		557.0	86.0
27	7.10	1.08	13.62		557.0	86.0
28	6.90	0.93	13.69		557.0	85.0
29	6.70	0.98	13.34		555.0	87.0
30	6.50	1.17	13.66		554.0	86.0
31	6.30	1.28	13.77		555.0	86.0
32	6.10	1.56	13.92		556.0	86.0
33	5.90	1.48	13.97		556.0	87.0
34	5.70	1.31	13.90		557.0	86.0
35	5.50	1.09	13.87		555.0	86.0
36	5.30	0.99	13.71		556.0	84.0
37	5.10	0.90	13.65		556.0	86.0
38	4.90	0.84	13.61		555.0	85.0
39	4.80	0.83	13.54		555.0	87.0
40	4.60	0.83	13.46		554.0	87.0
41	4.40	0.86	13.53		553.0	86.0
42	4.30	0.68	13.35		553.0	87.0
43	4.10	0.40	13.02		553.0	86.0
44	4.00	0.15	12.53		553.0	86.0
45	3.80	0.07	11.97		550.0	86.0
46	3.70	0.04	11.67		548.0	86.0
47	3.60	0.03	11.28		545.0	85.0
48	3.50	0.02	10.81		542.0	86.0
49	3.40	0.01	10.21		538	85
50	3.30	0	9.76		535	85
51	3.20	0	9.35		528	86
52	3.10	0	9.02		522	85
53	3.00	0	8.82		518	85
54	2.90	0	8.64		514	85

Note 2: In cases where the "Fuel Weight Remaining" is the same for three or more readings in a row, a "divide by zero error" will occur in the calculation sheet. In such cases, adjust the weight values by interpolation between the first occurrence and the next reading showing a decrease in weight.

55	2.90	0	8.56	510	85
56	2.80	0	8.41	506	85
57	2.70	0	8.36	502	84
58	2.60	0	8.37	498	84
59	2.60	0	8.25	496	86
60	2.50	0	8.22	492	84
61	2.40	0	8.22	489	86
62	2.40	0	8.11	485	85
63	2.30	0	8.06	483	85
64	2.20	0	8.05	479	85
65	2.20	0	8.07	477	86
66	2.10	0	8.13	475	85
67	2.10	0	8.22	472	86
68	2.00	0	8.27	471	85
69	1.90	0	8.17	469	86
70	1.90	0	7.99	468	86
71	1.80	0	7.75	466	86
72	1.80	0.01	7.55	462	85
73	1.80	0.01	7.48	460	85
74	1.80	0.01	7.46	457	85
75	1.60	0.01	7.4	456	85
76	1.60	0.01	7.39	453	85
77	1.60	0.01	7.46	450	85
78	1.50	0.01	7.5	450	86
79	1.50	0.01	7.46	448	86
80	1.40	0.01	7.31	446	85
81	1.40	0.01	7.1	445	86
82	1.30	0.01	6.88	442	86
83	1.40	0.01	6.86	440	86
84	1.30	0.01	6.85	437	86
85	1.20	0.01	6.92	435	85
86	1.20	0.01	6.89	433	85
87	1.10	0.01	6.75	431	85
88	1.10	0.01	6.76	430	85
89	1.10	0.01	6.73	428	86
90	1.00	0.01	6.71	426	86
91	1.00	0.01	6.76	424	85
92	1.00	0.01	6.79	423	85
93	0.90	0.01	6.81	421	85
94	0.90	0.01	6.72	420	85
95	1.00	0.01	6.57	419	85
96	0.80	0.01	6.63	418	85
97	0.80	0.01	6.63	416	86
98	0.80	0.01	6.6	417	86
99	0.80	0.01	6.65	415	86
100	0.70	0.01	6.66	415	86
101	0.70	0.01	6.7	414	86
102	0.70	0.01	6.67	413	85
103	0.60	0.01	6.65	413	85
104	0.60	0.01	6.7	412	85
105	0.70	0.01	6.71	411	85
106	0.50	0.01	6.66	410	86
107	0.60	0.01	6.66	409	86
108	0.50	0.01	6.61	408	85
109	0.50	0.01	6.6	405	85
110	0.40	0.01	6.55	406	86
111	0.40	0.01	6.55	404	85
112	0.40	0.01	6.55	404	86
113	0.50	0.01	6.48	403	86
114	0.30	0.01	6.49	401	85
115	0.40	0.01	6.49	402	86
116	0.30	0.01	6.42	400	85
117	0.20	0.01	6.35	400	86
118	0.20	0.01	6.32	400	85
119	0.20	0.01	6.33	399	86
120	0.20	0.02	6.34	398	85
121	0.10	0.01	6.32	398	85
122	0.10	0.02	6.31	398	85
123	0.00	0.02	6.35	397	85

### ASTM E2780 Wood Heater Run Sheets

Client: MF Fire \_\_\_\_\_ Project Number: 0552WS003E \_\_\_\_\_ Run Number: 4 \_\_\_\_\_  
 Model: Nova C \_\_\_\_\_ Tracking Number: 2468 \_\_\_\_\_ Date: 07/13/2023 \_\_\_\_\_  
 Test Crew: RT \_\_\_\_\_  
 OMNI Equipment ID numbers: \_\_\_\_\_

#### Wood Heater Run Notes

##### Air Control Settings

Primary:

fixed

Secondary:

\_\_\_\_\_  
*NA*

Tertiary/Pilot:

\_\_\_\_\_  
*NA*

Fan:

\_\_\_\_\_  
*NA*

##### Preburn Notes

Time	Notes
1157	At 2.5 lbs (startup) preburn fuel was loaded At 2.6 lbs (preburn) coals were leveled & main test start

##### Test Notes

Sketch test fuel configuration:

see Run

Start up procedures & Timeline:

Bypass: \_\_\_\_\_  
 Fuel loaded by: \_\_\_\_\_  
 Door closed at: \_\_\_\_\_  
 Primary air: \_\_\_\_\_

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Time	Notes
1305	Test start First hour shut off
1405	

Technician Signature: *Blk H.P. [Signature]*

Date: 9-27-23



**ASTM E2780 Wood Heater Run Sheets**

Client: MF Fire \_\_\_\_\_ Project Number: 0552WS003E \_\_\_\_\_ Run Number: 4 \_\_\_\_\_  
 Model: Nova C \_\_\_\_\_ Tracking Number: 2468 \_\_\_\_\_ Date: 07/13/2023 \_\_\_\_\_  
 Test Crew: RT \_\_\_\_\_  
 OMNI Equipment ID numbers: \_\_\_\_\_

**Wood Heater Supplemental Data**

Start Time: 1305 Booth #: \_\_\_\_\_

Stop Time: \_\_\_\_\_

**Stack Gas Leak Check:**

Initial:  Final: FAIL ✓  
*Pitot Failed Below*

**Sample Train Leak Check:**

A: 0.001 @ 15 "Hg  
 B: 0.002 @ 17 "Hg  
 1st 0.002 @ 15

Calibrations: Span Gas CO<sub>2</sub>: 16.84 CO: 4.38

.12  
 .11  
 .23  
 2.6  
 .30  
 .11  
 .19

	Pre Test		Post Test	
	Zero	Span	Zero	Span
Time	12:00	12:05	15:15	15:20
CO <sub>2</sub>	0.000	16.84	0.000	16.82
CO	0.00	4.39	-0.02	4.368
ppm	0	499.4	-1	498

Air Velocity (ft/min): Initial: 12 Final: 10  
 Scale Audit (lbs): Initial: 10.0 Final: 10.0  
 Pitot Tube Leak Test: Initial:  Final: Fail  
 Stack Diameter (in): 6  
 Induced Draft: None  
 % Smoke Capture: 100%  
 Flue Pipe Cleaned Prior to First Test in Series:  
 Date: see run 1 Initials: RT

Tunnel Traverse		
Microtector Reading	dP (in H <sub>2</sub> O)	T(°F)
1	.110	127
2	.056	127
3	.055	128
4	.054	128
5	.052	128
6	.055	128
7	.055	128
8	.054	128
Center:		
.055	0.110	124

	Initial	Middle	Ending
P <sub>b</sub> (in/Hg)	30.09	30.09	30.09
RH (%)	38	37	37
Ambient (°F)	85	85	86

Background Filter Volume: 18.836

Tunnel Static Pressure (in H <sub>2</sub> O):	
Beginning of Test	End of Test
-0.12	-0.12

Technician Signature: [Signature]

Date: 07-13-2023

### ASTM E2780 Wood Heater Run Sheets

Client: MF Fire \_\_\_\_\_ Project Number: 0552WS003E \_\_\_\_\_ Run Number: 4 \_\_\_\_\_  
 Model: Nova C \_\_\_\_\_ Tracking Number: 2468 \_\_\_\_\_ Date: 07/13/2023 \_\_\_\_\_  
 Test Crew: RT \_\_\_\_\_  
 OMNI Equipment ID numbers: \_\_\_\_\_

#### Wood Heater Fuel Data

Fuel: Douglas fir, untreated and air dried, standard grade or better dimensional lumber

Pre-Burn Fuel					
<b>Calibration:</b>		Cal Value (1) = 12%	Actual Reading	<u>12.0</u>	
		Cal Value (2) = 22%	Actual Reading	<u>12.0</u>	
<b>Piece:</b>	<b>Length:</b>	<b>Reading:</b>	<b>Piece:</b>	<b>Length:</b>	<b>Reading:</b>
1	<u>14.4</u> in	<u>23.3</u>	7	_____ in	_____
2	_____ in	<u>21.0</u>	8	_____ in	_____
3	_____ in	<u>24.0</u>	9	_____ in	_____
4	_____ in	_____	10	_____ in	_____
5	_____ in	_____	11	_____ in	_____
6	_____ in	_____	12	_____ in	_____
Total Pre-Burn Fuel Weight:		<u>9.3</u>	Pre-Burn Fuel Average Moisture: _____		
Time (clock):		<u>0900</u>	Room Temperature (F):	<u>77.0</u>	Initials: <u>RT</u>

Test Fuel					
Firebox Volume (ft <sup>3</sup> ):		<u>1.70</u>	Test Fuel Piece Length (in): <u>14</u>		
Load Weight Range (lb):		<u>10.8 - 13.0</u>	Total Wet Fuel Load Weight (lb): <u>12.4</u>		
Fuel Type & Amount: 2 x 4:		_____	4 x 4: _____		
Weight (with spacers):		<u>5.8</u>	Weight (with spacers): <u>6.6</u>		
<b>Piece:</b>	<b>Weight (lbs):</b>	<b>Moisture Readings (%DB):</b>			<b>Fuel Type:</b>
1	<u>1.9/1.4</u>	<u>20.4</u>	<u>24.2</u>	<u>23.8</u>	<u>2x4</u>
2	<u>1.9/1.5</u>	<u>19.4</u>	<u>19.3</u>	<u>19.3</u>	<u>2x4</u>
3	<u>2.0/1.6</u>	<u>21.1</u>	<u>19.2</u>	<u>19.8</u>	<u>2x4</u>
4	<u>2.0/2.8</u> <u>13.0</u>	<u>19.1</u>	<u>22.0</u>	<u>24.7</u>	<u>4x4</u>
5	<u>3.5/3.3</u>	<u>24.3</u>	<u>20.2</u>	<u>18.8</u>	<u>4x4</u>
6	_____	_____	_____	_____	_____
7	_____	_____	_____	_____	_____
<b>Spacer Moisture Readings (%DB)</b>					
<u>17.4</u>	<u>10.6</u>	<u>13.5</u>	<u>15.8</u>	_____	_____
<u>18.1</u>	<u>17.1</u>	<u>10.2</u>	<u>17.2</u>	_____	_____
<u>12.5</u>	<u>15.1</u>	<u>15.6</u>	<u>13.0</u>	_____	_____
<u>15.2</u>	<u>15.2</u>	<u>17.5</u>	<u>20.0</u>	_____	_____
Time (clock):		<u>1153</u>	Room Temperature (F):	<u>78</u>	Initials: <u>RT</u>

Technician Signature: rt K. M. [Signature] Date: 9-27-23

### ASTM E2780 Wood Heater Run Sheets

Client: MF Fire \_\_\_\_\_ Project Number: 0552WS003E \_\_\_\_\_ Run Number: 4 \_\_\_\_\_  
 Model: Nova C \_\_\_\_\_ Tracking Number: 2468 \_\_\_\_\_ Date: 07/13/2023 \_\_\_\_\_  
 Test Crew: RT \_\_\_\_\_  
 OMNI Equipment ID numbers: \_\_\_\_\_

#### ASTM E2515 Lab Sheet

Assembled By:

Riley Tiegs

Date/Time in Dessicator:

1530 07/13/2023

Weighing #1	Weighing #2	Weighing #3	Weighing #4	Weighing #5
Date/Time: 7-13-2023	Date/Time: 7-19-2023	Date/Time: 7-24-23	Date/Time: 7-27-23	
R/H %: 16.4	R/H %: 17.1	R/H %: 10.7	R/H %: 7.9	
Temp: 77.5	Temp: 77.8	Temp: 78	Temp: 77.3	
200 mg Audit: 200.1	200 mg Audit: 200.1	200 mg Audit: 199.9	200 mg Audit: 200.1	
2 g Audit: 2000.5	2 g Audit: 2000.3	2 g Audit: 2000.1	2 g Audit: 2000.2	
100 g Audit: 99997.9	100 g Audit: 99997.8	100 g Audit: 99997.8	100 g Audit: 99997.8	
Initials: RT	Initials: RT	Initials: RT	Initials: RT	

Train	Element	ID #	Tare (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)
A (First Hour)	Front Filter	F005	118.0 ✓	124.4	124.3 ✓			
	Rear Filter	F006	117.3 ✓	117.5	117.4 ✓			
	Probe	70	116834.0 ✓	116834.5	116834.4 ✓			
	O-Ring Set	5534	3290.2 ✓	3291.7	3291.4	3290.7 3291.2 ✓	3290.5 ✓	
A (Remainder)	Front Filter	F007	117.4 ✓	124.2	123.7	123.7 ✓		
	Rear Filter	F008	117.1 ✓	117.3	117.2 ✓			
	Probe	<del>37</del> 3535	114466.2 ✓	114466.8	114466.4			
	O-Ring Set	5535	<del>3350.3</del> 35	3351.7	3351.1	3350.7	3350.5 ✓	
B	Front Filter	F009	116.2 ✓	123.0	122.9 ✓			
	Rear Filter	F010	117.4 ✓	117.6	117.6 ✓			
	Probe	36	<del>114883.9</del> 124466.2 ✓	114884.6	114884.3	114884.1 ✓		
	O-Ring Set	5536	4147.4 ✓	4148.4	4148.0	4147.8 ✓		
BG	Filter	F011	116.4 ✓	116.4	116.4 ✓			

Technician Signature: Riley Tiegs

Date: 7-27-23

*MF Fire, Inc.  
Model: Nova C  
0552WS003E*

## Run 5 Test Data

# Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire  
 Model: Nova C  
 Project No.: 0552WS003E  
 Tracking No.: 2468  
 Run: 5  
 Test Date: 07/17/23

Technician Signature: \_\_\_\_\_

	<b>2.11 kg/hr dry</b> 114 degrees Fahrenheit 18.72 feet/second 11998.5 dscf/hour 0.095 inches H2O 134 minutes
--	--

	AMBIENT		SAMPLE TRAIN 1		SAMPLE TRAIN 2		FIRST HOUR FILTER (TRAIN 1)	
Total Sample Volume - Vm	20.543	cubic feet	21.653	cubic feet	21.376	cubic feet	9.702	cubic feet
Average Gas Meter Temperature	85	degrees Fahrenheit	92	degrees Fahrenheit	93	degrees Fahrenheit	89	degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmst	20.294	dscf	21.077	dscf	20.898	dscf	9.490	dscf
Total Particulates - m <sub>p</sub>	0	mg	4.3	mg	3.7	mg	0	mg
Particulate Concentration (dry-standard) - C <sub>p</sub> /C <sub>s</sub>	0.000000	grams/dscf	0.00020	grams/dscf	0.00018	grams/dscf	0.00000	grams/dscf
Total Particulate Emissions - E <sub>T</sub>	0.00	grams	5.47	grams	4.74	grams	0.00	grams
Particulate Emission Rate	0.00	grams/hour	2.45	grams/hour	2.12	grams/hour	0.00	grams/hour
Emissions Factor		grams/kg	1.16	g/kg	1.01	g/kg	0.00	g/kg
Difference from Average Total Particulate Emissions			0.36	grams	0.36	grams		
<b>Final Average Results</b>								
<b>Complete Test Run</b>								
Total Particulate Emissions - E <sub>T</sub>	5.11	grams						
Particulate Emission Rate	<b>2.29</b>	<b>grams/hour</b>						
Emissions Factor	1.08	grams/kg						
<b>First Hour Emissions</b>								
Total Particulate Emissions - E <sub>T</sub>	0.00	grams						
Particulate Emission Rate	0.00	grams/hour						
Emissions Factor	0.00	grams/kg						
7.5% of Average Total Particulate Emissions	0.38	grams						
<b>Quality Checks</b>								
			Requirement	Measured / Observed	Train 1	Train 2	Complies?	
Filter Temps, °F			< 90		86	88	OK	
Filter Face Velocity, fpm			< 30		8.84	10.71	OK	
Dryer Exit Temp, °F			< 80		65	69	OK	
Leakage Rate, cfm			0.01		0.002	0.003	OK	
< 4% of avg sample rate or < 0.01 cfm, lesser of the two								
Neg. Probe Weight			=> 0		0	0.1	OK	
Pro-Rate Variation			< 90 for < 10% of θ		0.00%	0.00%	OK	
			> 110 for < 10% of θ		0.00%	0.75%	OK	
# Readings > 80%			# Readings > 120%		0	0	OK	
Ambient Temp, °F (min / max)			< 55		0	1	Unacceptable	
Train Precision			> 90		83	86	OK	
One of A or B must			(A) Within 7.5%			7.1%	OK	
Stove Surface ΔT			(B) Within 0.5 g/kg			0.15	OK	
Room Air Velocity			Within 125 °F			31	OK	
			< 50 fpm			17	OK	

## Wood Heater Test Fuel Data - ASTM E2780

Manufacturer : MF Fire  
 Model : Nova C  
 Tracking No. : 2468  
 Project No. : 0552WS003E  
 Test Date : 7/17/2023  
 Run No. : 5

Moisture Meter Cal	
Cal Block	Measured
12.0	12.0
22.0	22.0

Firebox Volume : 1.70 ft<sup>3</sup>  
 % 2 x 4 Required : 35 - 65 %  
 Ideal Fuel Weight : 11.9 lb.  
 Minimum Fuel Weight : 10.71 lb.  
 Maximum Fuel Weight : 13.09 lb.

Fuel Piece Data										Wet Weights, lb		Dry Weights, lb	
PC #	Weight, lb	Size	Length, In	Moisture Readings, Dry Basis %			Average MC, % db	Dry Weight, lb.	Volume, ft <sup>3</sup>	4 x 4	2 x 4	4 x 4	2 x 4
1	1.20	2x4	14.00	19.1	20.2	20.1	19.8	1.00	0.0425		1.2		1.00
2	1.20	2x4	14.00	22.1	22.2	20.9	21.7	0.99	0.0425		1.2		0.99
3	1.70	2x4	14.00	20.5	22.8	20.1	21.1	1.40	0.0425		1.7		1.40
4	3.70	4x4	14.00	22.7	20.9	24.2	22.6	3.02	0.0992	3.7		3.02	
5	3.40	4x4	14.00	24.3	21.2	23.1	22.9	2.77	0.0992	3.4		2.77	
6													
7													
8													
9													

Spacer Data										
Moisture Readings, Dry Basis % (One reading per spacer)										
	12.4	10.9	12.3	15.5						
	10.1	14.0	13.6	13.6						
	17.0	17.1	15.5	16.0						
	16.2	14.2	13.2	14.7						
Avg : 14.1										

Assembled Crib Fuel Load with Spacers Attached									
PC #	Weight, lb with Spacers	Size	4 x 4s	2 x 4s					
1	1.50	2x4		1.5000	Combined Mass of 4 x 4s      7.5 lb Combined Mass of 2 x 4s      5.1 lb				
2	1.60	2x4		1.6000					
3	2.00	2x4		2.0000	Total Wet Mass of Fuel Load <b>12.6 lb</b>				
4	3.90	4x4	3.90						
5	3.60	4x4	3.60						
6									
7									
8									
9									

Fuel Load Properties									
Type	Number of Pieces	Wet Weight, lb.	Dry Weight, lb.	Fuel Loading Density, lb/ft <sup>3</sup>		Dry Fuel Density, lb/ft <sup>3</sup>	Wet Fuel Density, lb/ft <sup>3</sup>	Moisture, %	
				Wet Basis	Dry Basis			Dry Basis	Wet Basis
2 x 4	3	4.1	3.39	7.41	6.12	28.14	34.35	21.12	17.44
4 x 4	2	7.1	5.79						
Spacers	16	1.4	1.23						
Totals		12.6	10.40						

Compliance Checks					
	Fuel Load, Wet Lb.	Load Density, lb/ft <sup>3</sup> of FB vol	Fuel Density, lb/ft <sup>3</sup>	% of Fuel load mass which is 2x4	Fuel Load Peices Mositure, % db
Measured	12.6	7.41	28.14	40	21.6
Required	10.7 - 13.1	6.3 - 7.7	25 - 36	35 - 65	19 -25
Complies ?	Yes	Yes	Yes	Yes	Yes

## Wood Heater Preburn Data - ASTM E2780

**Run: 5**

Technician Signature \_\_\_\_\_

Manufacturer: MF Fire  
 Model: Nova C  
 Tracking No.: 2468  
 Project No.: 0552WS003E  
 Test Date: 7/17/23  
 Beginning Clock Time: 9:30

Preburn Fuel Data					
	1 pieces @	144	inches		
	pieces @	inches			
	pieces @	inches			
Fuel Moisture Readings (% DB):					
	19.4	22.3			
	20.1				
	21.7				
	20.1				
	23				
Avg Preburn Moisture (% DB): <b>21.10</b>					

Coal Bed	<b>2.5</b>	<b>3.2</b>
Range (lb):	(min)	(max)

Elapsed Time (min)	Scale (lb)	Stack Draft (in H <sub>2</sub> O)	Temperatures (°F)								
			FB Top	FB Bottom	FB Back	FB Left	FB Right	Cat Exit	Avg. FB	Stack	Ambient
0	10.6	-0.062	346	180	323	271	248	504	273.7	381	82
1	10.4	-0.071	354	182	324	273	250	893	276.6	372	82
2	10.3	-0.069	376	184	323	274	252	987	281.7	376	82
3	10.1	-0.07	405	186	321	275	254	1010	288.2	379	82
4	10	-0.072	436	188	319	275	256	1107	294.6	388	82
5	9.8	-0.073	473	190	316	275	257	1129	302	397	82
6	9.7	-0.073	501	191	313	276	258	1148	307.8	402	82
7	9.5	-0.074	525	193	311	277	259	1158	312.8	407	82
8	9.3	-0.074	552	194	309	277	260	1131	318.3	411	82
9	9.2	-0.074	569	196	307	279	260	1108	322.3	413	82
10	9.1	-0.075	581	198	305	280	261	1102	325	415	82
11	8.9	-0.075	592	199	304	281	263	1133	327.9	418	82
12	8.7	-0.075	601	201	303	283	264	1139	330.6	422	82
13	8.6	-0.075	617	203	303	285	265	1150	334.8	425	82
14	8.4	-0.075	624	204	303	288	267	1145	337.1	427	82
15	8.2	-0.075	633	206	304	290	268	1141	340.3	427	82
16	8.1	-0.076	635	207	305	294	271	1125	342.2	428	82
17	7.9	-0.076	650	209	306	296	273	1149	346.8	432	82
18	7.8	-0.076	652	211	307	299	275	1128	348.9	434	82
19	7.6	-0.076	660	212	309	302	278	1115	352.3	434	82
20	7.4	-0.076	660	214	311	305	281	1138	354	434	82
21	7.3	-0.076	671	215	313	308	284	1166	358.1	438	82
22	7.1	-0.076	678	216	316	311	287	1178	361.6	440	83
23	6.9	-0.077	688	218	318	314	290	1189	365.8	442	82
24	6.8	-0.076	695	219	320	318	294	1204	369.1	442	83
25	6.6	-0.076	702	221	323	321	297	1193	372.9	444	83
26	6.4	-0.076	712	222	325	324	300	1214	376.8	446	83
27	6.3	-0.076	718	224	328	328	304	1207	380.4	448	83
28	6.1	-0.075	726	225	330	332	308	1214	384.3	450	83
29	6	-0.076	734	227	333	336	311	1232	388	452	83
30	5.8	-0.077	743	229	336	339	315	1219	392.3	454	83
31	5.6	-0.078	743	230	339	344	318	1216	394.9	456	83
32	5.4	-0.078	751	232	342	348	322	1217	398.9	459	83
33	5.4	-0.078	757	233	346	352	325	1219	402.4	460	83
34	5.1	-0.077	763	235	349	356	328	1217	406.3	461	83
35	5	-0.076	760	236	352	360	332	1211	408.1	462	84
36	4.8	-0.077	771	238	356	365	336	1217	412.9	461	83
37	4.7	-0.077	770	239	359	369	339	1224	415.2	462	83
38	4.5	-0.077	773	241	362	373	343	1230	418.4	462	84
39	4.4	-0.076	772	243	366	377	346	1226	420.9	462	84
40	4.2	-0.077	769	244	370	382	349	1224	422.8	463	84
41	4.1	-0.077	774	246	373	386	352	1223	426.3	463	84
42	4	-0.076	774	247	377	390	355	1211	428.7	463	84

## Wood Heater Preburn Data - ASTM E2780

**Run: 5**

Technician Signature \_\_\_\_\_

Manufacturer: MF Fire  
 Model: Nova C  
 Tracking No.: 2468  
 Project No.: 0552WS003E  
 Test Date: 7/17/23  
 Beginning Clock Time: 9:30

Preburn Fuel Data				
	1 pieces @	144 inches		
	pieces @	inches		
	pieces @	inches		
Fuel Moisture Readings (% DB):				
	19.4	22.3		
	20.1			
	21.7			
	20.1			
	23			
Avg Preburn Moisture (% DB):				
<b>21.10</b>				

Coal Bed	<b>2.5</b>	<b>3.2</b>
Range (lb):	(min)	(max)

Elapsed Time (min)	Scale (lb)	Stack Draft (in H <sub>2</sub> O)	Temperatures (°F)								
			FB Top	FB Bottom	FB Back	FB Left	FB Right	Cat Exit	Avg. FB	Stack	Ambient
43	3.9	-0.076	766	249	381	394	358	1193	429.7	461	84
44	3.8	-0.076	758	251	385	399	361	1171	430.6	459	84
45	3.7	-0.076	746	252	388	402	364	1171	430.4	458	85
46	3.5	-0.077	747	254	392	406	366	1177	433	457	85
47	3.4	-0.076	738	255	395	410	369	1179	433.4	455	84
48	3.3	-0.075	732	257	399	413	371	1167	434.4	453	85
49	3.2	-0.075	728	258	402	416	373	1159	435.5	452	84
50	3.2	-0.075	725	260	407	419	375	1141	437.3	450	84
51	3.1	-0.074	714	262	411	421	377	1102	436.9	449	85
52	3	-0.072	711	263	415	424	379	1096	438.3	446	83
53	2.9	-0.073	702	264	419	426	381	1086	438.5	443	82
54	2.8	-0.072	696	266	424	428	383	1096	439.2	440	82
55	2.7	-0.072	688	267	428	430	384	1078	439.3	438	83
56	2.6	-0.071	678	268	433	431	386	1057	439.3	435	83
57	2.6	-0.07	673	270	437	432	387	1045	439.7	433	83
58	2.5	-0.071	664	270	440	434	388	1038	439.3	430	83
59	2.5	-0.07	656	272	443	435	389	1019	439.1	427	83
60	2.4	-0.069	646	274	447	436	390	976	438.5	424	84
61	2.4	-0.069	636	275	449	437	391	982	437.6	420	84
62	2.3	-0.068	628	277	451	438	391	953	437	418	84
63	2.3	-0.069	614	279	452	438	391	954	434.8	414	85
64	2.2	-0.069	612	281	453	438	391	928	435	411	84
65	4.8	-0.064	582	283	455	439	391	696	430.1	430	85
66	7.1	-0.093	568	285	456	439	391	684	427.7	522	85
67	6.9	-0.095	564	287	454	439	391	823	427	622	85
68	6.7	-0.095	559	289	451	438	390	882	425.4	660	85
69	6.5	-0.094	561	290	448	439	389	879	425.3	666	85
70	6.2	-0.093	557	292	447	440	389	868	425	666	85
71	6.1	-0.094	548	294	446	440	389	861	423.4	663	85
72	5.9	-0.079	554	295	447	442	389	963	425.4	598	85
73	5.8	-0.076	564	296	448	442	389	989	428	545	85
74	5.7	-0.076	568	298	449	443	391	995	429.8	514	84
75	5.6	-0.075	574	300	449	443	391	989	431.4	494	84
76	5.5	-0.075	581	301	448	443	391	980	433.1	480	85
77	5.4	-0.075	586	302	447	443	391	980	433.9	470	85
78	5.2	-0.073	590	304	446	442	392	993	434.7	462	84
79	5.1	-0.074	592	305	444	442	392	970	435	455	84
80	5	-0.073	595	307	443	441	392	975	435.6	449	84
81	4.9	-0.072	592	308	441	441	393	980	435	444	84
82	4.8	-0.072	599	309	440	441	393	1010	436.4	440	84
83	4.7	-0.072	601	310	439	441	394	987	436.8	436	84
84	4.6	-0.072	605	311	437	441	394	993	437.6	433	84
85	4.5	-0.072	607	312	437	441	395	991	438.4	432	84



## Wood Heater Preburn Data - ASTM E2780

**Run: 5**

Technician Signature \_\_\_\_\_

Manufacturer: MF Fire  
 Model: Nova C  
 Tracking No.: 2468  
 Project No.: 0552WS003E  
 Test Date: 7/17/23  
 Beginning Clock Time: 9:30

Preburn Fuel Data				
_____	1 pieces @	_____	144	inches
_____	pieces @	_____		inches
_____	pieces @	_____		inches
Fuel Moisture Readings (% DB):				
	19.4	22.3		
	20.1			
	21.7			
	20.1			
	23			
Avg Preburn Moisture (% DB):				
<b>21.10</b>				

Coal Bed	<b>2.5</b>	<b>3.2</b>
Range (lb):	(min)	(max)

Elapsed Time (min)	Scale (lb)	Stack Draft (in H <sub>2</sub> O)	Temperatures (°F)								
			FB Top	FB Bottom	FB Back	FB Left	FB Right	Cat Exit	Avg. FB	Stack	Ambient
86	4.3	-0.072	611	313	436	441	395	1005	439.3	432	85
87	4.2	-0.072	615	315	435	440	396	1028	440.2	430	84
88	4.1	-0.072	617	315	436	441	397	1030	441.1	429	85
89	4	-0.072	619	316	436	442	397	1026	441.7	428	85
90	3.9	-0.071	623	316	436	442	398	1030	443.2	427	83
91	3.8	-0.071	625	316	436	443	399	1031	444	426	84
92	3.7	-0.071	626	317	437	444	399	1011	444.7	426	85
93	3.6	-0.07	631	319	438	444	400	1013	446.4	425	85
94	3.5	-0.072	628	320	439	445	401	1044	446.5	424	85
95	3.3	-0.071	616	320	441	446	402	911	444.8	462	85
96	3.2	-0.072	621	322	443	446	402	1025	446.8	442	85
97	3.2	-0.071	619	323	445	447	403	1025	447.3	432	85
98	3.1	-0.071	614	324	447	447	404	976	447.1	426	85
99	3	-0.072	613	324	449	448	405	966	447.6	421	84
100	3	-0.071	609	324	451	448	405	981	447.4	418	84
101	2.9	-0.071	605	324	453	447	405	959	446.9	415	85
102	2.8	-0.07	599	325	454	447	405	958	446	412	85
103	2.6	-0.08	586	326	457	447	406	724	444.3	461	85







# Wood Heater Test Data

Run: 5  
Manufacturer: MF Fire  
Model: Nova C  
Tracking No.: 2483  
Project No.: 2024165030E  
Beginning Clock Time: 11:14

PM Control Modules: 335,338  
Dilution Tunnel MM(dry): 29.00 Ibb-mole  
Dilution Tunnel MM(wet): 29.73 Ibb-mole  
Dilution Tunnel MM(H<sub>2</sub>O): 2.00 Ibb-mole  
Tunnel Area: 0.18335 ft<sup>2</sup>  
Pilot Tube Cp: 0.59

Avg. Tunnel Velocity: 16.72 ft/sec.  
Initial Tunnel Flow: 202.9 scfm  
Avg. Tunnel Velocity: 16.72 ft/sec.  
Post-Test Leak Check (1): 0.0034 cfm @ 16 in. Hg  
Post-Test Leak Check (2): 0.0034 cfm @ 23 in. Hg  
Average Test Piece Fuel Moisture: 21.12 Dry Basis %

Avg. Tunnel Velocity: 16.72 ft/sec.  
Initial Tunnel Flow: 202.9 scfm  
Avg. Tunnel Velocity: 16.72 ft/sec.  
Post-Test Leak Check (1): 0.0034 cfm @ 16 in. Hg  
Post-Test Leak Check (2): 0.0034 cfm @ 23 in. Hg  
Average Test Piece Fuel Moisture: 21.12 Dry Basis %

Technician Signature:

Velocity Traverse Data		
PL1	PL2	PL3
0.060	0.090	0.060
115	115	115
115	115	115

Velocity Traverse Data		
PL4	PL5	PL6
0.060	0.090	0.060
115	115	115
115	115	115

Fuel Weight (lb)		
PL7	PL8	PL9
0.096	0.070	0.098
115	115	115
115	115	115

Temperature Data (F)		
Stack	Exhaust	Exhaust
356	357	357
82	82	82
83	83	83

Stack Gas Data		
Draft	CO <sub>2</sub>	CO
-0.065	6.42	0.01
-0.066	6.53	0.01
-0.065	6.65	0.01

Particle Sampling Data		
Meter 1	Meter 2	Orifice
2.02	2.02	2.02
94	94	94
94	94	94

Particulate Sampling Data		
Meter 1	Meter 2	Orifice
2.02	2.02	2.02
94	94	94
94	94	94

Particulate Sampling Data		
Meter 1	Meter 2	Orifice
2.02	2.02	2.02
94	94	94
94	94	94

Particulate Sampling Data		
Meter 1	Meter 2	Orifice
2.02	2.02	2.02
94	94	94
94	94	94

Particulate Sampling Data		
Meter 1	Meter 2	Orifice
2.02	2.02	2.02
94	94	94
94	94	94

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OMNI Equipment Numbers:

Meter Box Y Factor: 1.007 (1) 1.015 (2) 1.012 (Amb)

Biometric Pressure: 30.14 Middle 30.14 Average 30.14

Room Air Velocity: 17

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# Wood Heater Test Data

**Run:** 5  
 Manufacturer: MF Fire  
 Model: Nova C  
 Tracking No.: 2488  
 Project No.: 20240500E  
 Test Date: 11/14/2024  
 Beginning Clock Time: 11:14  
 Total Sampling Time: 134 min  
 Recording Interval: 6 min  
 Turn Down Time: 6 min  
 Background Sample Volume: 20,543 cubic feet

Meter Box Y Factor: 1.007 (1) 1.015 (2) 1.012 (Amb)  
 Barometric Pressure: 30.14 Middle 30.14 Average 30.14 Room Air Velocity: 17  
 OMNI Equipment Numbers:

PM Control Modules: 335,338  
 Dilution Tunnel MM(dry): 29.00 lb-b-mole  
 Dilution Tunnel MM(wet): 28.78 lb-b-mole  
 Dilution Tunnel SDC: 2.00 percent  
 Dilution Tunnel SDC H<sub>2</sub>O: 0.00 percent  
 Tunnel Area: 0.18635 ft<sup>2</sup>  
 Pilot Tube Cp: 0.59  
 Avg. Tunnel Velocity: 16.72 ft/sec.  
 Initial Tunnel Flow: 202.9 scfm  
 Average Chamber Flow: 200.0 scfm  
 Post-Test Leak Check (1): -0.003 cfm @ 16 in. Hg  
 Post-Test Leak Check (2): -0.003 cfm @ 16 in. Hg  
 Average Test Piece Fuel Moisture: 21.12 Dry Basis %

Velocity Traverse Data		Temperature Data (F)	
Pt.1	Pt.2	Pt.3	Pt.4
Initial dp	0.062	0.090	0.060
Temp	115	115	115

Elapsed Time (min)	Particulate Sampling Data				Fuel Weight (lb)				Temperature Data (F)				Stack Gas Data															
	Gas Meter 1 (ft <sup>3</sup> )	Gas Meter 2 (ft <sup>3</sup> )	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH1 (H <sub>2</sub> O) (°F)	Meter 1 Temp (°F)	Orifice dH2 (H <sub>2</sub> O) (°F)	Meter 2 Vacuum (°Hg)	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firibox Top	Firibox Bottom	Firibox Back	Firibox Left	Firibox Right	Avg. Stove Surface (Tot=At)	Stack Catalyst Exit	Stack	Filter 1	Filter 2	Driver Exit 2	Ambient	Drift (H <sub>2</sub> O)	CO <sub>2</sub> (%)	CO (%)	
133	21.491	21.217	0.16	0.16	1.24	94	2.02	0.90	95	98	98	0	481	334	436	427	381	412	833	356	82	65	83	66	85	-0.064	6.27	0.01
134	21.653	21.376	0.16	0.16	1.23	94	2.02	0.91	95	100	99	-0.1	482	333	436	427	380	412	822	355	82	65	83	66	84	-0.064	6.24	0.01

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## Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire \_\_\_\_\_ Equipment Numbers: \_\_\_\_\_  
 Model: Nova C \_\_\_\_\_  
 Tracking No.: 2468 \_\_\_\_\_  
 Project No.: 0552WS003E \_\_\_\_\_  
 Run #: 5 \_\_\_\_\_  
 Date: 7/17/23 \_\_\_\_\_

**TRAIN 1 (First Hour emissions)**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter				0.0
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:    0.0

**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	F014	120.2	116.4	3.8
C. Rear filter catch	Filter	F015	117.6	117.4	0.2
D. Probe catch*	Probe	17	114562.2	114562.0	0.2
E. Filter seals catch*	Seals	S538	3277.4	3277.3	0.1

**Sub-Total**    Total Particulate, mg:    4.3

**Train 1 Aggregate**    Total Particulate, mg:    4.3

**TRAIN 2**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	F016	120.4	116.9	3.5
B. Rear filter catch	Filter	F017	116.9	116.8	0.1
C. Probe catch*	Probe	50	118126.7	118126.6	0.1
D. Filter seals catch*	Seals	S539	3350.8	3350.8	0.0

**Total Particulate, mg:    3.7**

**AMBIENT**

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch*	Filter	F018	116.1	116.2	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: \_\_\_\_\_

## Run 5 First Hour Emissions Data



# Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire  
 Model: Nova C  
 Project No.: 0552WS003E  
 Tracking No.: 2468  
 Run: 5  
 Test Date: 07/17/23

Technician Signature: \_\_\_\_\_

Burn Rate	<b>4.72 kg/hr dry</b>
Average Tunnel Temperature	121 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	18.86 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	11953.2 dscf/hour
Average Delta p	0.095 inches H2O
Total Time of Test	60 minutes

	AMBIENT		SAMPLE TRAIN 1		SAMPLE TRAIN 2		FIRST HOUR FILTER (TRAIN 1)	
Total Sample Volume - Vm	20.543 cubic feet	9.416 cubic feet	9.416 cubic feet	0.000 cubic feet	9.416 cubic feet	9.416 cubic feet	9.416 cubic feet	9.416 cubic feet
Average Gas Meter Temperature	85 degrees Fahrenheit	81 degrees Fahrenheit	81 degrees Fahrenheit	#DIV/0!	81 degrees Fahrenheit	81 degrees Fahrenheit	81 degrees Fahrenheit	81 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmst	20.277 dscf	9.363 dscf	9.363 dscf	#DIV/0!	9.363 dscf	9.363 dscf	9.363 dscf	9.363 dscf
Total Particulates - m <sub>p</sub>	0 mg	4.3 mg	4.3 mg	0 mg	4.3 mg	4.3 mg	4.3 mg	4.3 mg
Particulate Concentration (dry-standard) - C <sub>p</sub> /C <sub>s</sub>	0.000000 grams/dscf	0.00046 grams/dscf	0.00046 grams/dscf	#DIV/0!	0.00046 grams/dscf	0.00046 grams/dscf	0.00046 grams/dscf	0.00046 grams/dscf
Total Particulate Emissions - E <sub>T</sub>	0.00 grams	5.49 grams	5.49 grams	#DIV/0!	5.49 grams	5.49 grams	5.49 grams	5.49 grams
Particulate Emission Rate	0.00 grams/hour	5.49 grams/hour	5.49 grams/hour	#DIV/0!	5.49 grams/hour	5.49 grams/hour	5.49 grams/hour	5.49 grams/hour
Emissions Factor		1.16 g/kg	1.16 g/kg	#DIV/0!	1.16 g/kg	1.16 g/kg	1.16 g/kg	1.16 g/kg
Difference from Average Total Particulate Emissions		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
<b>Final Average Results</b>								
<b>Complete Test Run</b>								
Total Particulate Emissions - E <sub>T</sub>	#DIV/0!	grams	Filter Temps, °F	Requirement	Measured / Observed	Train 1	Train 2	Complies?
Particulate Emission Rate	#DIV/0!	grams/hour	Filter Face Velocity, fpm	< 90	First Hour	88	88	OK
Emissions Factor	#DIV/0!	grams/kg	Dryer Exit Temp, °F	< 30	70	10.18	0.00	OK
			Leakage Rate, cfm	< 80	0.002	0.004	0.003	OK
			< 4% of avg sample rate or	0.01	0.7	0	0	OK
			< 0.01 cfm, lesser of the two	=> 0	0.00%	0.00%	#DIV/0!	#DIV/0!
<b>First Hour Emissions</b>			Neg. Probe Weight	< 90 for < 10% of θ	1.67%	1.67%	#DIV/0!	#DIV/0!
Total Particulate Emissions - E <sub>T</sub>	5.49	grams	Pro-Rate Variation	> 110 for < 10% of θ	0	0	0	OK
Particulate Emission Rate	5.49	grams/hour	# Readings > 80%	# Readings > 120%	1	1	0	Unacceptable
Emissions Factor	-11.28	grams/kg	Ambient Temp, °F	< 55	84	86	84	OK
7.5% of Average Total Particulate Emissions	#DIV/0!	grams	(min / max)	> 90				OK
			Train Precision	(A) Within 7.5%				#DIV/0!
			One of A or B must	(B) Within 0.5 g/kg				#DIV/0!
			Stove Surface ΔT	Within 125 °F				OK
			Room Air Velocity	< 50 fpm				OK



Run: 5

Manufacturer: MF Fire
Model: Nova C
Tracking No.: 2483
Project No.: 202416500E
Test Operator: JLD

Total Sampling Time: 60 min
Recording Interval: 6 min
Test Duration: 60 min
Background Sample Volume: 20,543 cubic feet

Table with columns for Meter Box Y Factor, Biometric Pressure, and Room Air Velocity. Values include 1.007, 1.015, 1.012, 1.012, 17.

OMNI Equipment Numbers:

Wood Heater Test Data

PM Control Modules: 371,338
Dilution Tunnel MM(dry): 29.00
Dilution Tunnel MM(wet): 28.78
Dilution Tunnel S.D.C.: 2.00
Dilution Tunnel S.D.C.: 2.00
Tunnel Area: 0.18535 ft2
Plot Tube Cp: 0.59

Table with columns for Velocity Traverse Data (P.L1 to P.L8) and Fuel Weight Change. Includes values for initial dP, Temp, and Weight Change.

Technician Signature:

Main data table with columns for Time (min), Gas Meter 1, Gas Meter 2, Particulate Sampling Data, Fuel Weight (lb), Temperature Data (F), and Stack Gas Data. Contains 60 rows of test data.

## Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire \_\_\_\_\_ Equipment Numbers: \_\_\_\_\_  
 Model: Nova C \_\_\_\_\_  
 Tracking No.: 2468 \_\_\_\_\_  
 Project No.: 0552WS003E \_\_\_\_\_  
 Run #: 5 \_\_\_\_\_  
 Date: 7/17/23 \_\_\_\_\_

**TRAIN 1 (First Hour emissions)**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	F012	119.3	115.9	3.4
C. Rear filter catch	Filter	F013	117.7	117.6	0.1
D. Probe catch*	Probe	31	114363.2	114362.5	0.7
E. Filter seals catch*	Seals	S539	3314.4	3314.3	0.1

**Sub-Total**    Total Particulate, mg:    **4.3**

**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				0.0
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:    **0.0**

**Train 1 Aggregate**    Total Particulate, mg:    **4.3**

**TRAIN 2**

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

Total Particulate, mg:    **0.0**

**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: \_\_\_\_\_

# OMNI-Test Laboratories

**Manufacturer:** MF Fire  
**Model:** Nova C  
**Date:** 07/17/23  
**Run:** 5  
**Control #:**  
**Test Duration:** 134  
**Output Category:** SBR

**Technicians:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## Test Results in Accordance with CSA B415.1-10

	HHV Basis	LHV Basis
Overall Efficiency	72.0%	77.8%
Combustion Efficiency	96.0%	96.0%
Heat Transfer Efficiency	75%	81.1%

Output Rate (kJ/h)	30,375	28,814	(Btu/h)
Burn Rate (kg/h)	2.13	4.69	(lb/h)
Input (kJ/h)	42,175	40,008	(Btu/h)

Test Load Weight (dry kg)	4.75	10.48	dry lb
MC wet (%)	16.83		
MC dry (%)	20.24		
Particulate (g)	0		
CO (g)	276		
Test Duration (h)	2.23		

Emissions	Particulate	CO
g/MJ Output	0.00	4.07
g/kg Dry Fuel	0.00	58.01
g/h	0.00	123.51
lb/MM Btu Output	0.00	9.45

Air/Fuel Ratio (A/F)	12.41
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VERSION:

2.4

4/15/2010

VERSION: 2.4 4/15/2010

Manufacturer: MF Fire  
 Model: Nova C  
 Date: 7/17/2023  
 Run: 5  
 Control #:   
 Test Duration: 134  
 Output Category: SBR

Appliance Type: Cat (Cat, Non-Cat, Pellet)

Temp. Units F (F or C)  
 Weight Units lb (kg or lb)

**Default Fuel Values**

	D. Fir	Oak
HHV (kJ/kg)	19,810	19,887
%C	48.73	50
%H	6.87	6.6
%O	43.9	42.9
%Ash	0.5	0.5

Wood Moisture (% wet): 16.83  
 Load Weight (lb wet): 12.60  
 Burn Rate (dry kg/h): 2.13  
 Total Particulate Emissions: g

**Fuel Data**

	D. Fir	kJ/kg
HHV	19,810	
%C	48.73	
%H	6.87	
%O	43.9	
%Ash	0.5	

Note 1: For other fuels, use the heating value and fuel composition determined by analysis of fuel sample in accordance with Clause 9.2.

Averages 0.33 8.61 #DIV/0! 419.07 84.64

Elapsed Time (min)	Fuel Weight Remaining (lb)	Flue Gas Composition (%)			Temp. (°F)	
		CO	CO <sub>2</sub>	O <sub>2</sub>	Flue Gas	Room Temp
0	12.60	0.04	4.12		455.0	85.0
1	12.50	0.15	5.04		430.0	85.0
2	12.30	0.03	5.75		420.0	86.0
3	12.20	0.04	7.85		418.0	85.0
4	12.00	0.27	12.04		425.0	85.0
5	11.80	0.20	12.35		433.0	85.0
6	11.60	0.79	12.59		441.0	85.0
7	11.40	1.51	13.82		451.0	84.0
8	11.20	0.86	13.38		457.0	84.0
9	11.00	0.87	13.46		463.0	84.0
10	10.70	1.30	13.47		468.0	84.0
11	10.50	1.05	13.60		472.0	85.0
12	10.30	1.26	13.81		476.0	85.0
13	10.00	1.84	13.73		481.0	85.0
14	9.70	2.01	13.81		485.0	85.0
15	9.50	1.89	13.75		488.0	86.0
16	9.20	1.86	13.67		489.0	85.0
17	9.00	1.68	13.78		491.0	85.0
18	8.80	1.74	13.73		493.0	86.0
19	8.50	1.75	13.58		493.0	85.0
20	8.30	1.70	13.56		494.0	85.0
21	8.00	1.67	13.58		495.0	85.0
22	7.80	1.62	13.61		497.0	86.0
23	7.60	1.63	13.63		497.0	86.0
24	7.40	1.59	13.60		497.0	85.0
25	7.20	1.61	13.80		498.0	85.0
26	6.90	1.57	13.81		498.0	86.0
27	6.70	1.44	13.95		499.0	86.0
28	6.50	1.13	13.85		499.0	86.0
29	6.30	0.99	13.71		499.0	86.0
30	6.10	0.95	13.46		499.0	86.0
31	5.90	1.01	13.49		499.0	85.0
32	5.70	1.02	13.34		499.0	85.0
33	5.60	0.87	13.16		498.0	86.0
34	5.40	0.73	12.64		497.0	85.0
35	5.20	0.65	12.25		496.0	85.0
36	5.10	0.47	11.88		494.0	85.0
37	4.90	0.33	11.60		492.0	85.0
38	4.80	0.33	11.34		490.0	85.0
39	4.60	0.30	11.00		488.0	85.0
40	4.50	0.21	10.79		486.0	85.0
41	4.40	0.18	10.51		483.0	85.0
42	4.30	0.14	10.33		481.0	85.0
43	4.20	0.14	10.05		478.0	85.0
44	4.00	0.13	9.83		476.0	85.0
45	3.90	0.12	9.72		473.0	85.0
46	3.80	0.06	9.61		471.0	86.0
47	3.70	0.05	9.42		469.0	85.0
48	3.60	0.02	9.16		465.0	85.0
49	3.50	0.01	8.84		463	85
50	3.40	0	8.39		460	85
51	3.40	0	8.11		457	85
52	3.30	0	7.4		453	85
53	3.20	0	7.22		450	85
54	3.10	0	7.09		446	85

Note 2: In cases where the "Fuel Weight Remaining" is the same for three or more readings in a row, a "divide by zero error" will occur in the calculation sheet. In such cases, adjust the weight values by interpolation between the first occurrence and the next reading showing a decrease in weight.

55	3.10	0	7.01	443	84
56	3.00	0	6.96	440	85
57	3.00	0	6.96	437	85
58	2.90	0.01	6.96	435	84
59	2.80	0.01	6.96	431	85
60	2.80	0.01	7.01	429	85
61	2.70	0.01	6.98	426	84
62	2.60	0.01	7.05	424	85
63	2.60	0.01	7.06	422	84
64	2.50	0.01	7.06	419	84
65	2.50	0.01	6.92	417	85
66	2.40	0.01	6.93	415	85
67	2.40	0.01	6.89	414	84
68	2.40	0.01	6.89	412	84
69	2.20	0.01	6.78	410	84
70	2.20	0.01	6.83	408	84
71	2.30	0.01	6.85	407	85
72	2.10	0	6.87	405	86
73	2.00	0	6.87	403	85
74	2.00	0	6.91	401	85
75	1.90	0	6.92	399	85
76	1.90	0	6.94	399	85
77	1.80	0	6.8	398	85
78	1.80	0	6.66	395	84
79	1.70	0	6.52	394	85
80	1.70	0.01	6.31	393	84
81	1.70	0.01	6.2	391	84
82	1.60	0.01	6.07	388	84
83	1.60	0.01	6.05	386	84
84	1.60	0.01	6.09	384	84
85	1.50	0.01	6.18	382	84
86	1.50	0.01	6.27	380	85
87	1.40	0.01	6.18	379	84
88	1.40	0.01	6.2	377	84
89	1.40	0.01	6.2	375	84
90	1.30	0.01	6.14	373	84
91	1.30	0.01	6.15	372	84
92	1.30	0.01	6.28	370	84
93	1.30	0.01	6.31	369	84
94	1.20	0.01	6.37	368	84
95	1.20	0.01	6.32	367	84
96	1.20	0.01	6.33	365	84
97	1.10	0.01	6.39	364	84
98	1.10	0.01	6.42	363	84
99	1.10	0.01	6.42	363	84
100	1.00	0.01	6.53	361	84
101	1.00	0.01	6.6	361	84
102	1.00	0.01	6.65	361	84
103	0.90	0.01	6.7	360	84
104	0.90	0.01	6.77	360	84
105	0.90	0.01	6.8	359	84
106	0.90	0.01	6.78	359	84
107	0.80	0.01	6.82	358	84
108	0.80	0.01	6.84	359	84
109	0.80	0.01	6.84	358	84
110	0.70	0.01	6.76	358	84
111	0.70	0.01	6.79	358	84
112	0.70	0.01	6.79	358	84
113	0.60	0.01	6.79	358	84
114	0.60	0.01	6.85	358	83
115	0.60	0.01	6.49	358	84
116	0.60	0.01	6.52	358	84
117	0.50	0.01	6.53	358	84
118	0.50	0.01	6.55	358	84
119	0.50	0.01	6.59	357	84
120	0.40	0.01	6.59	357	85
121	0.40	0.01	6.57	356	84
122	0.40	0.01	6.45	356	84
123	0.30	0.01	6.49	356	84
124	0.30	0.01	6.42	356	85
125	0.30	0.01	6.35	356	85
126	0.30	0.01	6.44	356	85
127	0.20	0.01	6.41	357	85
128	0.20	0.01	6.27	357	85

128	0.20	0.01	6.21		356	84
130	0.10	0.01	6.22		357	84
131	0.10	0.01	6.25		356	85
132	0.10	0.01	6.29		356	84
133	0.10	0.01	6.27		356	85
134	0.00	0.01	6.24		355	84



Client: MF Fire \_\_\_\_\_ Project Number: 0552WS003E \_\_\_\_\_ Run Number: 5 \_\_\_\_\_  
 Model: Nova C \_\_\_\_\_ Tracking Number: 2468 \_\_\_\_\_ Date: 7/17/2023 \_\_\_\_\_  
 Test Crew: \_\_\_\_\_  
 OMNI Equipment ID numbers: \_\_\_\_\_

**Wood Heater Run Notes**

**Air Control Settings**

Primary:

Secondary: N/A

*Fixed (single burn-rate unit)*

Tertiary/Pilot: N/A

Fan: N/A

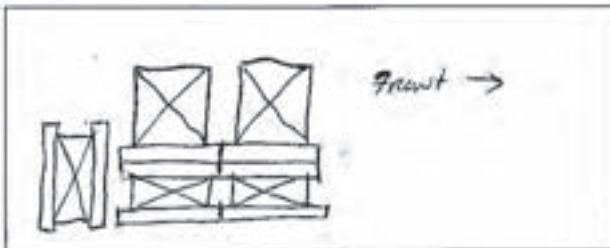
**Preburn Notes**

Time	Notes
0930	At 2.0 lbs startup fuel, pre burn was loaded
1032	At 2.31 lbs added 5.1 lbs pre burn fuel Moisture 20.1, 23.0, 22.3
1103	Levelled coal bed

**Test Notes**

Sketch test fuel configuration:

Start up procedures & Timeline:



Bypass: Used  
 Fuel loaded by: 30  
 Door closed at: 35  
 Primary air: N/A

Notes: \_\_\_\_\_

Time	Notes
1114	test start
1214	first hour sampling stopped

Technician Signature: s/o K. Mag

Date: 9-27-23

**ASTM E2780 Wood Heater Run Sheets**

Client: MF Fire \_\_\_\_\_ Project Number: 0552WS003E \_\_\_\_\_ Run Number: 5  
 Model: Nova C \_\_\_\_\_ Tracking Number: 2468 \_\_\_\_\_ Date: 7/17/2023  
 Test Crew: \_\_\_\_\_  
 OMNI Equipment ID numbers: \_\_\_\_\_

**Wood Heater Supplemental Data**

Start Time: 11:14 Booth #: \_\_\_\_\_

Stop Time: 13:27

**Stack Gas Leak Check:**

Initial:  Final:

**Sample Train Leak Check:**

A: 0.002 @ 10" Hg

B: 0.004 @ 16" Hg

First hour: 0.003 at 23 m Hg

Calibrations: Span Gas CO<sub>2</sub>: 16.84 CO: 4.38

	Pre Test		Post Test	
	Zero	Span	Zero	Span
Time	<u>1018</u>	<u>1020</u>	<u>1411</u>	<u>1415</u>
CO <sub>2</sub>	<u>0.00</u>	<u>16.84</u>	<u>0.000</u>	<u>16.81</u>
CO	<u>0.00</u>	<u>4.38</u>	<u>-0.01</u>	<u>4.376</u>

ppm 0 500 2 498

Air Velocity (ft/min): Initial: 17 Final:

Scale Audit (lbs): Initial: 10.0 Final:

Pitot Tube Leak Test: Initial:  Final:

Stack Diameter (in): 6

Induced Draft: N/A none

% Smoke Capture: 100%

Flue Pipe Cleaned Prior to First Test in Series:

Date: See Run 1 Initials: Rt

	Initial	Middle	Ending
P <sub>b</sub> (in/Hg)	<u>30.14</u>	/	<u>30.14</u>
RH (%)	<u>39</u>	/	<u>38</u>
Ambient (°F)	<u>85</u>	/	<u>84</u>

Tunnel Traverse		
Microtector Reading	dP (in H <sub>2</sub> O)	T(°F)
1	<u>-0.31</u>	<u>115</u>
2	<u>-0.43</u>	<u>115</u>
3	<u>-0.45</u>	<u>115</u>
4	<u>-0.03</u>	<u>115</u>
5	<u>-0.30</u>	<u>115</u>
6	<u>-0.45</u>	<u>115</u>
7	<u>-0.48</u>	<u>115</u>
8	<u>-0.35</u>	<u>115</u>
Center:		
<u>-0.49</u>	<u>-0.98</u>	<u>115</u>
<u>0.098</u>		

Tunnel Static Pressure (in H <sub>2</sub> O):	
Beginning of Test	End of Test
<u>-0.30</u>	<u>-0.30</u>

Background Filter Volume: \_\_\_\_\_

Technician Signature: [Signature]

Date: 7-17-2023

### ASTM E2780 Wood Heater Run Sheets

Client: MF Fire \_\_\_\_\_ Project Number: 0552WS003E \_\_\_\_\_ Run Number: 5 \_\_\_\_\_  
 Model: Nova C \_\_\_\_\_ Tracking Number: 2468 \_\_\_\_\_ Date: 7/17/2023 \_\_\_\_\_  
 Test Crew: RT \_\_\_\_\_  
 OMNI Equipment ID numbers: \_\_\_\_\_

#### Wood Heater Fuel Data

Fuel: Douglas fir, untreated and air dried, standard grade or better dimensional lumber

Pre-Burn Fuel					
<b>Calibration:</b>		Cal Value (1) = 12%	Actual Reading	<u>12.0</u>	
		Cal Value (2) = 22%	Actual Reading	<u>22.0</u>	
<b>Piece:</b>	<b>Length:</b>	<b>Reading:</b>	<b>Piece:</b>	<b>Length:</b>	<b>Reading:</b>
1	<u>14.4</u> in	<u>19.4</u>	7	_____ in	_____
2	_____ in	<u>20.1</u>	8	_____ in	_____
3	_____ in	<u>21.7</u>	9	_____ in	_____
4	_____ in	_____	10	_____ in	_____
5	_____ in	_____	11	_____ in	_____
6	_____ in	_____	12	_____ in	_____
Total Pre-Burn Fuel Weight:		<u>8.7</u>	Pre-Burn Fuel Average Moisture: _____		
Time (clock):		<u>0800</u>	Room Temperature (F):		<u>81</u> Initials: <u>RT</u>

Test Fuel					
Firebox Volume (ft <sup>3</sup> ):		<u>1.70</u>	Test Fuel Piece Length (in): <u>14</u>		
Load Weight Range (lb):		<u>10.8 - 13.0</u>	Total Wet Fuel Load Weight (lb): <u>12.6</u>		
Fuel Type & Amount:		2 x 4: <u>5.1</u>	4 x 4: <u>7.5</u>		
Weight (with spacers):		<u>5.1</u>	Weight (with spacers): <u>7.5</u>		
<b>Piece:</b>	<b>Weight (lbs):</b>	<b>Moisture Readings (%DB):</b>			<b>Fuel Type:</b>
1	<u>1.5/1.2</u>	<u>19.1</u>	<u>20.2</u>	<u>20.1</u>	<u>2x4</u>
2	<u>1.6/1.2</u>	<u>22.1</u>	<u>22.2</u>	<u>20.9</u>	<u>2x4</u>
3	<u>2.0/1.7</u>	<u>20.5</u>	<u>22.8</u>	<u>20.1</u>	<u>2x4</u>
4	<u>3.4/3.7</u>	<u>22.7</u>	<u>20.9</u>	<u>24.2</u>	<u>4x4</u>
5	<u>3.6/3.4</u>	<u>24.3</u>	<u>21.2</u>	<u>23.1</u>	<u>4x4</u>
6	_____	_____	_____	_____	_____
7	_____	_____	_____	_____	_____
<b>Spacer Moisture Readings (%DB)</b>					
<u>12.4</u>	<u>10.9</u>	<u>12.3</u>	<u>15.5</u>	_____	_____
<u>10.1</u>	<u>14.0</u>	<u>13.6</u>	<u>13.6</u>	_____	_____
<u>17.0</u>	<u>17.1</u>	<u>15.5</u>	<u>16.0</u>	_____	_____
<u>16.2</u>	<u>14.2</u>	<u>13.2</u>	<u>14.7</u>	_____	_____
Time (clock):		<u>1009</u>	Room Temperature (F):		<u>81</u> Initials: <u>RT</u>

Technician Signature: Bl K/Maga

Date: 9-29-23

**ASTM E2780 Wood Heater Run Sheets**

Client: MF Fire \_\_\_\_\_ Project Number: 0552WS003E \_\_\_\_\_ Run Number: 5 \_\_\_\_\_  
 Model: Nova C \_\_\_\_\_ Tracking Number: 2468 \_\_\_\_\_ Date: 7/17/2023 \_\_\_\_\_  
 Test Crew: \_\_\_\_\_  
 OMNI Equipment ID numbers: \_\_\_\_\_

**ASTM E2515 Lab Sheet**

Assembled By:

Riley T

Date/Time in Dessicator:

First hour only 1300 7-17-2023  
 Remainder 1400

Weighing #1	Weighing #2	Weighing #3	Weighing #4	Weighing #5
Date/Time: 7-17-23	Date/Time: 7-19-23	Date/Time: 7-24-2023	Date/Time: 7-27-23	Date/Time: 08-07-23
R/H %: 16.4	R/H %: 17.1	R/H %: 17.1 10.7	R/H %: 7.9	R/H %: 9.8
Temp: 77.5	Temp: 77.8	Temp: 78.0	Temp: 77.3	Temp: 77.8
200 mg Audit: 200.1	200 mg Audit: 200.1	200 mg Audit: 199.9	200 mg Audit: 200.1	200 mg Audit: 200.1
2 g Audit: 2006.5	2 g Audit: 2006.3	2 g Audit: 2000.1	2 g Audit: 2000.2	2 g Audit: 2000.1
100 g Audit: 99997.9	100 g Audit: 99997.8	100 g Audit: 99997.8	100 g Audit: 99997.8	100 g Audit: 99997.8
Initials: RT	Initials: RD	Initials: TC	Initials: RO	Initials: RT

Train	Element	ID #	Tare (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)
A (First Hour)	Front Filter	F012	115.9 ✓	119.8	119.5	119.3		
	Rear Filter	F013	117.6 ✓	117.6	117.7 ✓			
	Probe	31	114362.5 ✓	114363.1	114363.1	114363.2 ✓		
A (Remainder)	O-Ring Set	<del>5537</del> 5539	<del>3314.3</del> 3332.8 ✓	3316.4	3315.9	3314.9	3314.4	3314.4 ✓
	Front Filter	F014	116.4 ✓	120.4	120.2	120.2 ✓		
	Rear Filter	F015	117.4 ✓	117.7	117.6 ✓			
	Probe	17	114562.0 ✓	114562.4	114562.2 ✓			
	O-Ring Set	<del>5537</del> 5539	3277.3 ✓	3280.0	3278.8	3277.9	3277.5	3277.4 ✓
B	Front Filter	F016	116.9 ✓	120.9	120.5	120.2	120.9 ✓	
	Rear Filter	F017	116.8 ✓	116.9	116.9 ✓			
	Probe	50	118126.6 ✓	118126.8	118126.7 ✓			
	O-Ring Set	<del>5537</del> 5539	3350.8 ✓	3353.0	3352.0	3351.2	3350.7	3350.8 ✓
BG	Filter	F018	116.2 ✓	116.1	116.1 ✓			

Technician Signature: 13/6 K.A. Morgan

Date: 9-27-23

## Run 6 Test Data

# Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire  
 Model: NovaC  
 Project No.: 0552WS003E  
 Tracking No.: 2468  
 Run: 6  
 Test Date: 08/15/23

Technician Signature: \_\_\_\_\_

Burn Rate  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	<b>1.72 kg/hr dry</b>  124 degrees Fahrenheit 18.77 feet/second 11761.8 dscf/hour  0.098 inches H2O 155 minutes
--	--

	AMBIENT		SAMPLE TRAIN 1		SAMPLE TRAIN 2		FIRST HOUR FILTER (TRAIN 1)	
	grams	grams/hour	grams	grams/hour	grams	grams/hour	grams	grams/hour
Total Sample Volume - Vm	24.943		26.491		26.215		10.152	
Average Gas Meter Temperature	88		98		99		94	
Total Sample Volume (Standard Conditions) - Vmst	24.373		25.376		25.237		9.786	
Total Particulates - m <sub>p</sub>	0.1		4.1		4.2		0	
Particulate Concentration (dry-standard) - C <sub>p</sub> /C <sub>s</sub>	0.000004		0.00016		0.00017		0.00000	
Total Particulate Emissions - E <sub>T</sub>	0.12		4.78		4.93		0.00	
Particulate Emission Rate	0.05		1.85		1.91		0.00	
Emissions Factor			1.08		1.11		0.00	
Difference from Average Total Particulate Emissions			0.07		0.07		0.00	
<b>Final Average Results</b>								
<b>Complete Test Run</b>			<b>Requirement</b>		<b>Measured / Observed</b>		<b>Complies?</b>	
Total Particulate Emissions - E <sub>T</sub>	4.86	grams	Filter Temps, °F	< 90	Train 1	Train 2		
Particulate Emission Rate	1.88	grams/hour	Filter Face Velocity, fpm	< 30	85	86	OK	
Emissions Factor	1.09	grams/kg	Dryer Exit Temp, °F	< 80	9.16	9.27	OK	
			Leakage Rate, cfm	0.01	77	77	OK	
			< 4% of avg sample rate or		0.000	0.001	OK	
			< 0.01 cfm, lesser of the two		0	0	OK	
			Neg. Probe Weight	=> 0	0	0	OK	
<b>First Hour Emissions</b>								
Total Particulate Emissions - E <sub>T</sub>	0.00	grams	< 90 for < 10% of θ		0.00%	0.00%	OK	
Particulate Emission Rate	0.00	grams/hour	> 110 for < 10% of θ		0.00%	0.00%	OK	
Emissions Factor	0.00	grams/kg	# Readings < 80%		0	0	OK	
			# Readings > 120%		0	0	OK	
7.5% of Average Total Particulate Emissions	0.36	grams	Ambient Temp, °F	< 55	86	86	OK	
			(min / max)	> 90	89	89	OK	
			Train Precision	(A) Within 7.5%	1.5%		OK	
			One of A or B must	(B) Within 0.5 g/kg	0.03		OK	
			Stove Surface ΔT	Within 125 °F	39		OK	
			Room Air Velocity	< 50 fpm	27		OK	

## Wood Heater Test Fuel Data - ASTM E2780

Manufacturer : MF Fire  
 Model : NovaC  
 Tracking No. : 2468  
 Project No. : 0552WS003E  
 Test Date : 8/15/2023  
 Run No. : 6

Moisture Meter Cal	
Cal Block	Measured
12.0	12.0
22.0	22.0

Firebox Volume : 1.70 ft<sup>3</sup>  
 % 2 x 4 Required : 35 - 65 %  
 Ideal Fuel Weight : 11.9 lb.  
 Minimum Fuel Weight : 10.71 lb.  
 Maximum Fuel Weight : 13.09 lb.

Fuel Piece Data										Wet Weights, lb		Dry Weights, lb	
PC #	Weight, lb	Size	Length, In	Moisture Readings, Dry Basis %			Average MC, % db	Dry Weight, lb.	Volume, ft <sup>3</sup>	4 x 4	2 x 4	4 x 4	2 x 4
1	1.20	2x4	14.00	24.9	20.1	22.1	22.4	0.98	0.0425		1.2		0.98
2	1.10	2x4	14.00	22.4	21.9	21.0	21.8	0.90	0.0425		1.1		0.90
3	1.20	2x4	14.00	25.0	21.6	24.9	23.8	0.97	0.0425		1.2		0.97
4	3.80	4x4	14.00	22.0	21.6	22.3	22.0	3.12	0.0992	3.8		3.12	
5	3.20	4x4	14.00	23.1	22.2	22.0	22.4	2.61	0.0992	3.2		2.61	
6													
7													
8													
9													

Spacer Data										
Moisture Readings, Dry Basis % (One reading per spacer)										
	8.3	8.2	7.5	8.0						Avg : 8.0
	7.9	8.1	8.0	8.3						
	7.5	8.2	7.7	8.0						
	7.9	8.0	7.7	8.1						

Assembled Crib Fuel Load with Spacers Attached									
PC #	Weight, lb with Spacers	Size	4 x 4s	2 x 4s					
1	1.70	2x4		1.7000	Combined Mass of 4 x 4s      6.7 lb Combined Mass of 2 x 4s      5.1 lb				
2	1.70	2x4		1.7000					
3	1.70	2x4		1.7000					
4	3.60	4x4	3.60		Total Wet Mass of Fuel Load      11.8 lb				
5	3.10	4x4	3.10						
6									
7									
8									
9									

Fuel Load Properties									
Type	Number of Pieces	Wet Weight, lb.	Dry Weight, lb.	Fuel Loading Density, lb/ft <sup>3</sup>		Dry Fuel Density, lb/ft <sup>3</sup>	Wet Fuel Density, lb/ft <sup>3</sup>	Moisture, %	
				Wet Basis	Dry Basis			Dry Basis	Wet Basis
2 x 4	3	3.5	2.85	6.94	5.76	26.32	32.20	20.57	17.06
4 x 4	2	7.0	5.73						
Spacers	16	1.3	1.20						
Totals		11.8	9.79						

Compliance Checks					
	Fuel Load, Wet Lb.	Load Density, lb/ft <sup>3</sup> of FB vol	Fuel Density, lb/ft <sup>3</sup>	% of Fuel load mass which is 2x4	Fuel Load Peices Mositure, % db
Measured	11.8	6.94	26.32	43	22.5
Required	10.7 - 13.1	6.3 - 7.7	25 - 36	35 - 65	19 - 25
Complies ?	Yes	Yes	Yes	Yes	Yes

## Wood Heater Preburn Data - ASTM E2780

**Run: 6**

Technician Signature \_\_\_\_\_

Manufacturer: MF Fire  
 Model: NovaC  
 Tracking No.: 2468  
 Project No.: 0552WS003E  
 Test Date: 8/15/23

Beginning Clock Time: \_\_\_\_\_

Coal Bed	<b>2.4</b>	<b>3.0</b>
Range (lb):	(min)	(max)

Preburn Fuel Data					
4 pieces @	14 inches				
3 pieces @	10 inches				
1 pieces @	5 inches				
Fuel Moisture Readings (% DB):					
			22.6	22.2	
			23	23.3	
			22		
			21.7		
			22.5		
Avg Preburn Moisture (% DB):			<b>22.47</b>		

Elapsed Time (min)	Scale (lb)	Stack Draft (in H <sub>2</sub> O)	Temperatures (°F)								
			FB Top	FB Bottom	FB Back	FB Left	FB Right	Cat Exit	Avg. FB	Stack	Ambient
0	10.8	-0.045	520	226	378	348	296	722	353.4	473	83
1	10.7	-0.047	506	228	378	348	297	849	351.4	439	82
2	10.6	-0.046	494	229	377	348	298	863	349.4	436	82
3	10.5	-0.047	483	231	375	349	300	870	347.5	441	82
4	10.4	-0.048	475	232	371	347	301	944	345.4	448	82
5	10.3	-0.048	470	233	368	347	302	975	343.8	452	81
6	10.2	-0.049	471	235	363	346	302	938	343.3	460	81
7	10	-0.049	479	236	359	345	301	967	344.2	468	81
8	9.9	-0.051	503	238	355	344	301	1048	348.1	483	81
9	9.7	-0.051	529	239	350	343	301	1102	352.5	492	81
10	9.5	-0.052	553	240	347	342	301	1114	356.5	497	83
11	9.3	-0.052	575	241	343	340	299	1140	359.6	502	81
12	9.1	-0.054	594	242	341	340	300	1116	363	508	83
13	9	-0.054	609	243	339	339	299	1100	365.6	513	83
14	8.8	-0.054	622	243	336	339	300	1118	368.2	517	82
15	8.6	-0.055	634	245	335	340	301	1185	371	524	82
16	8.4	-0.055	647	246	335	340	301	1171	373.5	527	83
17	8.2	-0.055	660	247	334	341	302	1155	376.7	529	83
18	8	-0.055	673	247	333	341	303	1192	379.5	532	83
19	7.8	-0.055	685	248	333	343	305	1178	382.9	533	83
20	7.6	-0.056	696	250	333	344	306	1211	386	533	83
21	7.5	-0.056	704	250	334	346	306	1147	388.1	536	84
22	7.3	-0.057	713	251	335	348	309	1209	391.3	537	83
23	7.1	-0.057	720	252	337	351	312	1164	394.3	538	84
24	6.9	-0.056	727	253	339	354	314	1204	397.3	541	84
25	6.7	-0.057	733	254	340	357	316	1177	400	541	85
26	6.6	-0.056	738	256	343	360	319	1218	403.1	543	84
27	6.4	-0.057	742	257	346	363	320	1205	405.4	544	85
28	6.2	-0.057	746	257	348	365	323	1217	408	544	84
29	6	-0.056	751	258	351	369	327	1189	411.2	545	83
30	5.9	-0.056	754	259	354	373	330	1159	414	547	85
31	5.7	-0.057	758	261	357	377	333	1159	417	548	83
32	5.6	-0.058	762	262	359	380	334	1206	419.4	551	85
33	5.3	-0.058	767	262	362	382	336	1221	421.8	553	85
34	5.2	-0.057	775	263	365	387	340	1230	426	554	85
35	5	-0.057	783	264	368	390	344	1190	429.9	556	83
36	4.8	-0.057	791	265	371	394	347	1185	433.6	558	85
37	4.7	-0.056	799	266	374	398	351	1197	437.4	556	86
38	4.5	-0.057	804	268	377	402	354	1229	440.7	554	86
39	4.3	-0.057	807	269	380	405	357	1214	443.7	554	86
40	4.2	-0.056	810	270	383	409	361	1202	446.7	553	86
41	4.1	-0.056	811	271	386	413	364	1179	449	554	86
42	3.9	-0.056	811	272	390	416	367	1227	451.2	553	86



## Wood Heater Preburn Data - ASTM E2780

**Run: 6**

Technician Signature: \_\_\_\_\_

Manufacturer: MF Fire  
 Model: NovaC  
 Tracking No.: 2468  
 Project No.: 0552WS003E  
 Test Date: 8/15/23

Beginning Clock Time: \_\_\_\_\_

Coal Bed	<b>2.4</b>	<b>3.0</b>
Range (lb):	(min)	(max)

Preburn Fuel Data					
4 pieces @	14 inches				
3 pieces @	10 inches				
1 pieces @	5 inches				
Fuel Moisture Readings (% DB):					
			22.6	22.2	
			23	23.3	
			22		
			21.7		
			22.5		
Avg Preburn Moisture (% DB):			<b>22.47</b>		

Elapsed Time (min)	Scale (lb)	Stack Draft (in H <sub>2</sub> O)	Temperatures (°F)								
			FB Top	FB Bottom	FB Back	FB Left	FB Right	Cat Exit	Avg. FB	Stack	Ambient
43	3.8	-0.056	808	273	393	419	370	1221	452.8	549	86
44	3.7	-0.056	803	275	396	423	372	1169	454	548	86
45	3.6	-0.056	798	276	400	426	375	1168	455.1	545	84
46	3.4	-0.056	792	277	404	429	378	1155	456.3	545	3218
47	3.3	-0.056	787	279	408	432	381	1140	457.5	543	83
48	3.2	-0.055	781	280	412	435	383	1132	458.1	540	83
49	3.1	-0.055	774	281	416	438	385	1128	459	538	84
50	3	-0.055	766	282	420	441	387	1097	459.5	534	84
51	2.9	-0.054	759	284	424	444	389	1092	459.9	531	84
52	2.9	-0.054	751	285	427	447	391	1098	460.1	529	84
53	2.8	-0.054	745	286	431	449	393	1093	460.7	526	84
54	2.7	-0.053	739	287	434	451	394	1084	461.2	522	84
55	2.6	-0.053	733	288	438	453	395	1068	461.5	520	85
56	2.5	-0.053	724	289	441	454	396	1045	460.8	516	84
57	2.5	-0.052	714	290	444	456	396	1023	460.3	511	84
58	2.4	-0.052	704	291	447	458	397	1008	459.6	506	84
59	2.4	-0.052	692	293	451	460	397	994	458.4	502	85
60	2.3	-0.051	681	294	454	461	398	978	457.6	498	85
61	2.3	-0.05	670	295	458	462	398	964	456.4	494	85
62	2.2	-0.049	659	296	461	463	398	951	455.3	489	85
63	2.2	-0.049	648	297	464	463	397	936	453.8	485	85
64	2.2	-0.05	632	297	470	464	396	810	452	533	85
65	2.1	-0.048	615	301	473	464	396	801	449.7	473	85
66	2.1	-0.048	601	303	473	464	396	832	447.4	462	85
67	2.1	-0.047	589	304	473	463	396	838	445.1	457	85
68	3.3	-0.054	578	304	473	462	395	830	442.6	481	85
69	10.4	-0.047	560	305	471	461	394	718	438.4	460	86
70	10.5	-0.055	548	306	469	460	393	816	435.3	460	85
71	10.1	-0.051	549	306	464	457	392	908	433.9	469	85
72	10	-0.051	556	307	459	454	391	952	433.6	480	84
73	9.8	-0.053	567	308	453	451	389	975	433.8	489	85
74	9.6	-0.053	581	308	447	449	387	991	434.4	496	85
75	9.4	-0.054	596	309	442	446	386	1005	435.8	501	85
76	9.3	-0.054	609	310	437	443	385	1002	436.7	502	84
77	9.1	-0.054	618	310	433	441	384	999	437.3	502	85
78	8.9	-0.054	626	311	429	439	382	998	437.3	503	85
79	8.8	-0.054	631	312	426	438	381	1001	437.5	503	85
80	8.6	-0.054	636	312	423	436	380	1005	437.4	504	85
81	8.5	-0.055	640	312	420	434	380	1009	437.4	505	85
82	8.3	-0.055	645	313	418	434	380	1020	438	507	85
83	8.1	-0.054	651	313	416	434	380	1034	438.6	512	85
84	8	-0.055	657	312	415	433	380	1039	439.4	514	85
85	7.8	-0.055	663	313	414	433	380	1045	440.5	517	85

## Wood Heater Preburn Data - ASTM E2780

**Run: 6**

Technician Signature \_\_\_\_\_

Manufacturer: MF Fire  
 Model: NovaC  
 Tracking No.: 2468  
 Project No.: 0552WS003E  
 Test Date: 8/15/23

Beginning Clock Time: \_\_\_\_\_

Preburn Fuel Data					
4 pieces @	14 inches				
3 pieces @	10 inches				
1 pieces @	5 inches				
Fuel Moisture Readings (% DB):					
			22.6	22.2	
			23	23.3	
			22		
			21.7		
			22.5		
Avg Preburn Moisture (% DB):			<b>22.47</b>		

Coal Bed	<b>2.4</b>	<b>3.0</b>
Range (lb):	(min)	(max)

Elapsed Time (min)	Scale (lb)	Stack Draft (in H <sub>2</sub> O)	Temperatures (°F)								
			FB Top	FB Bottom	FB Back	FB Left	FB Right	Cat Exit	Avg. FB	Stack	Ambient
86	7.6	-0.056	669	314	414	433	380	1048	441.8	516	85
87	7.5	-0.055	674	314	413	434	381	1057	443.3	519	86
88	7.3	-0.055	680	313	413	434	381	1061	444.4	521	85
89	7.2	-0.055	685	314	413	435	382	1063	445.7	522	86
90	7	-0.055	690	314	413	436	382	1071	447.1	524	86
91	6.9	-0.056	696	314	414	437	383	1078	448.9	527	86
92	6.7	-0.057	702	314	415	438	384	1089	450.4	529	86
93	6.5	-0.057	709	314	416	438	385	1101	452.4	531	86
94	6.4	-0.058	717	314	417	440	387	1112	454.8	534	86
95	6.3	-0.058	725	314	417	441	386	1127	456.7	536	86
96	6.1	-0.058	734	314	418	442	387	1145	459.2	539	86
97	5.9	-0.061	743	313	419	443	384	1160	460.4	541	86
98	5.7	-0.06	752	313	421	444	383	1171	462.5	542	87
99	5.6	-0.063	759	313	421	444	383	1173	464.1	542	87
100	5.4	-0.063	764	312	422	444	385	1184	465.5	542	86
101	5.3	-0.064	771	311	424	446	383	1195	467.1	542	86
102	5.1	-0.06	777	311	425	447	383	1190	468.6	542	86
103	5	-0.06	782	310	426	448	383	1200	470	543	86
104	4.8	-0.059	788	310	429	450	386	1209	472.5	543	86
105	4.6	-0.061	793	309	431	451	388	1211	474.4	542	87
106	4.5	-0.058	798	309	433	453	387	1208	476.1	539	87
107	4.4	-0.06	803	309	436	455	388	1213	478.1	535	87
108	4.3	-0.059	808	308	438	456	387	1221	479.4	533	87
109	4.2	-0.058	810	308	440	458	389	1210	481	532	87
110	4.1	-0.06	807	308	441	459	391	1190	481.3	530	87
111	4	-0.058	800	307	443	461	393	1168	480.9	527	88
112	3.9	-0.057	792	307	446	463	393	1148	480	521	88
113	3.8	-0.054	783	307	449	465	397	1122	480.4	517	88
114	3.8	-0.054	774	308	452	468	400	1102	480.4	514	88
115	3.7	-0.053	763	308	456	470	402	1084	479.6	512	88
116	3.3	-0.053	751	308	459	471	404	1058	478.6	507	88
117	3.3	-0.053	738	308	461	473	406	1031	477.3	504	87
118	3.2	-0.053	725	309	464	474	407	1014	475.7	499	88
119	3.2	-0.054	711	308	465	473	403	1000	472	494	88
120	3.2	-0.057	698	307	466	473	402	988	469.3	488	88
121	3.1	-0.055	685	308	468	472	402	974	467.1	483	88
122	3.1	-0.056	673	307	469	472	401	959	464.6	477	88
123	3	-0.053	661	307	471	471	400	945	462.2	472	88
124	3	-0.054	649	307	472	470	400	933	459.7	467	88
125	3	-0.051	638	307	473	469	399	922	457.6	462	88
126	3	-0.05	629	307	474	468	398	913	454.9	458	88
127	2.9	-0.05	618	307	475	466	398	904	452.9	455	88
128	2.9	-0.049	609	307	475	465	396	895	450.4	451	88

## Wood Heater Preburn Data - ASTM E2780

**Run: 6**

Technician Signature: \_\_\_\_\_

Manufacturer: MF Fire  
 Model: NovaC  
 Tracking No.: 2468  
 Project No.: 0552WS003E  
 Test Date: 8/15/23

Beginning Clock Time: \_\_\_\_\_

Coal Bed	<b>2.4</b>	<b>3.0</b>
Range (lb):	(min)	(max)

Preburn Fuel Data					
_____	4 pieces @	_____	14 inches		
_____	3 pieces @	_____	10 inches		
_____	1 pieces @	_____	5 inches		
Fuel Moisture Readings (% DB):					
		22.6	22.2		
		23	23.3		
		22			
		21.7			
		22.5			
Avg Preburn Moisture (% DB):					
<b>22.47</b>					

Elapsed Time (min)	Scale (lb)	Stack Draft (in H <sub>2</sub> O)	Temperatures (°F)								
			FB Top	FB Bottom	FB Back	FB Left	FB Right	Cat Exit	Avg. FB	Stack	Ambient
129	3.2	-0.047	600	306	475	463	396	887	448.2	448	87
130	3.2	-0.048	591	307	475	462	393	881	445.7	445	88
131	3.2	-0.048	584	306	475	460	393	875	443.7	443	88
132	3.1	-0.049	576	307	474	459	393	870	441.7	441	88
133	3.1	-0.045	571	308	475	458	395	865	441.3	438	88
134	3.2	-0.045	566	308	475	457	395	860	440.2	438	88
135	3	-0.045	561	309	474	456	395	856	439.2	438	88
136	3	-0.044	557	310	474	455	397	853	438.3	438	88
137	3	-0.045	553	310	473	454	397	850	437.2	437	87
138	3	-0.045	549	310	472	453	397	848	436.2	436	88
139	2.9	-0.045	546	311	472	451	396	846	435.1	436	88

Wood Heater Test Data

Run: 6

Manufacturer: MF Fire
Model: Nova3C
Tracking No.: 2483
Project No.: 102765003E
Invoice No.: 11024729
Beginning Clock Time: 11:04:29

Total Sampling Time: 155 min
Recording Interval: 5 min
Flow Rate: 6 cfm
Background Sample Volume: 24,943 cubic feet

PM Control Modules: 335,338
Dilution Tunnel MM(dry): 29.00 lbb-mole
Dilution Tunnel MM(wet): 28.73 lbb-mole
Dilution Tunnel SFC(dry): 2.00 g-H2O
Dilution Tunnel SFC(wet): 2.00 g-H2O
Tunnel Area: 0.148335 ft2
Pilot Tube Cp: 0.59

Avg. Tunnel Velocity: 16.77 ft/sec
Initial Tunnel Flow: 194.9 scfm
Avg. Tunnel Velocity: 15.00 ft/sec
Post-Test Leak Check (1): 0.003 cfm @ 5 in. Hg
Post-Test Leak Check (2): 0.003 cfm @ 5 in. Hg
Post-Test Leak Check (3): 0.003 cfm @ 5 in. Hg
Average Test Piece Fuel Moisture: 20.57 Dry Basis %

Technician Signature: \_\_\_\_\_

Table with 4 columns: Meter Box Y Factor, Biometric Pressure, OMNI Equipment Numbers, Room Air Velocity. Values include 1.007, 1.015, 29.99, 29.96, 29.98, 27.

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Temperature Data (F) table with columns: Avg. Stove Surface Temperature, Fuel Weight Change, Fuel Weight Scale Reading, Fuel Weight Pro. Rate, Fuel Weight Pro. Rate 2, Fuel Weight Pro. Rate 1, Fuel Weight Pro. Rate 2, Fuel Weight Pro. Rate 1, Fuel Weight Pro. Rate 2, Fuel Weight Pro. Rate 1, Fuel Weight Pro. Rate 2.

Main data table with 15 columns: Time, Gas Meter 1, Gas Meter 2, Sample Rate 1, Sample Rate 2, Office dH1, Office dH2, Meter 1 Vacuum, Meter 2 Vacuum, Dilution Tunnel Center dp, Dilution Tunnel Center dp, Pro. Rate Pro. Rate 2, Pro. Rate Pro. Rate 1, Fuel Weight Change, Fuel Weight Scale Reading, Fuel Weight Pro. Rate, Fuel Weight Pro. Rate 2, Fuel Weight Pro. Rate 1, Fuel Weight Pro. Rate 2, Fuel Weight Pro. Rate 1, Fuel Weight Pro. Rate 2, Filtration, Ambient, CO2, CO.

Run: 6

Manufacturer: MF Fire
Model: Nova3C
Tracking No.: 2483
Project No.: 1927016500E
Invoice No.: 11024-29

Total Sampling Time: 155 min
Recording Interval: 6 min
Total Volume: 24,943 cubic feet

Meter Box Y Factor: 1.007 (1) 1.015 (2) 1.012 (Amb)

Biometric Pressure:
Begin Middle End Average
29.99 29.96 29.98 27

OMNI Equipment Numbers:

Wood Heater Test Data

PM Control Modules: 335,338
Dilution Tunnel MM(dry): 29.00
Dilution Tunnel MM(wet): 28.73
Dilution Tunnel MM(H2O): 27.00

Avg. Tunnel Velocity: 16.77 ft/sec.
Initial Tunnel Flow: 194.9 scfm
Avg. Tunnel Flow: 193.0 scfm

Table with 12 columns: P.L.1, P.L.2, P.L.3, P.L.4, P.L.5, P.L.6, P.L.7, P.L.8, Center, Firebox Bottom, Firebox Top, Firebox Left, Firebox Right, Avg. Stove Surface Temperature, Catalyst Exit, Stack, Filter 1, Filter 2, Driver Exit 2, Ambient, CO, CO2, Draift (H2O), %.

Velocity Traverse Data
P.L.1 P.L.2 P.L.3 P.L.4 P.L.5 P.L.6 P.L.7 P.L.8 Center
Initial dp 0.059 0.096 0.088 0.064 0.056 0.082 0.090 0.098 0.098 H2O
Temp: 127 127 128 128 127 127 127 126 126 F

Main data table with columns: Elapsed Time (min), Gas Meter 1 (ft³), Gas Meter 2 (ft³), Sample Rate 1 (cfm), Sample Rate 2 (cfm), Office dH1 (H2O), Office dH2 (H2O), Meter 1 Vacuum, Meter 2 Vacuum, Dilution Tunnel Center dp, Pro. Rate 1, Pro. Rate 2, Fuel Weight Scale Reading, Weight Change, Firebox Bottom, Firebox Top, Firebox Left, Firebox Right, Avg. Stove Surface Temperature, Catalyst Exit, Stack, Filter 1, Filter 2, Driver Exit 2, Ambient, CO, CO2, Draift (H2O), %.



### Wood Heater Test Data

U

Run: 6

Manufacturer: MF Fire  
 Model: Nova3C  
 Tracking No.: 2483  
 Project No.: 1927165008E  
 Beginning Clock Time: 11:04:29

PM Control Modules: 335,338  
 Dilution Tunnel MM(dry): 29.00 Ibb-mole  
 Dilution Tunnel MM(wet): 28.73 Ibb-mole  
 Dilution Tunnel SDC: 2.00 Percent  
 Tunnel Area: 0.18535 ft<sup>2</sup>  
 Pilot Tube Cp: 0.59

Avg. Tunnel Velocity: 16.77 ft/sec.  
 Initial Tunnel Flow: 194.9 scfm  
 Average Chamber Flow: 193.0 scfm  
 Post-Test Leak Check (1): 0.003 cfm @ 5 in. Hg  
 Post-Test Leak Check (2): 0.003 cfm @ 7 in. Hg  
 Average Test Piece Fuel Moisture: 20.57 Dry Basis %

Technician Signature: \_\_\_\_\_

Meter Box Y Factor: 1.007	(1)	1.015	(2)	1.012	(Amb)
Barometric Pressure: 29.99	Begin	Middle	Average	29.96	29.98
Room Air Velocity: 27					

PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8	Center
Initial dP	0.059	0.066	0.064	0.056	0.082	0.090	0.098	0.098
Temp:	127	127	128	128	127	127	126	126
V <sub>ave</sub>	18.75		ft/sec		21.84		ft/sec	
F <sub>p</sub>	0.858		q <sub>w</sub>					

Velocity Traverse Data	PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8	Center
Temp:	127	127	128	128	127	127	127	126	126
V <sub>ave</sub>	18.75		ft/sec		21.84		ft/sec		0.858
F <sub>p</sub>	0.858		q <sub>w</sub>						

OMNI Equipment Numbers:

Temperature Data (F)

Stack Gas Data	Draft (H <sub>2</sub> O)	CO <sub>2</sub> (%)	CO (%)
99	88	-0.045	5.33
100	87	-0.045	5.31
101	87	-0.045	5.37
102	87	-0.044	5.36
103	87	-0.043	5.36
104	87	-0.043	5.38
105	87	-0.044	5.41
106	87	-0.044	5.41
107	87	-0.043	5.42
108	88	-0.043	5.42
109	88	-0.042	5.45
110	88	-0.043	5.41
111	88	-0.043	5.18
112	87	-0.043	5.11
113	88	-0.043	5.11
114	88	-0.043	5.12
115	88	-0.042	5.34
116	88	-0.042	5.4
117	88	-0.043	5.44
118	88	-0.043	5.49
119	88	-0.043	5.49
120	88	-0.044	5.5
121	88	-0.043	5.51
122	88	-0.042	5.53
123	88	-0.043	5.44
124	88	-0.043	5.44
125	88	-0.043	5.44
126	88	-0.043	5.4
127	88	-0.043	5.48
128	86	-0.042	5.47
129	86	-0.043	5.49
130	86	-0.043	5.44
131	86	-0.043	5.4
132	86	-0.042	5.41

Temperature Data (F)	Avg. Stove Surface (Tot=At)	Filter 1	Filter 2	Driver Exit 2	Ambient
421	387	421	805	421	805
419	385	419	803	419	803
418	383	418	800	418	800
416	383	416	797	416	797
414	383	414	794	414	794
413	381	413	791	413	791
412	380	412	789	412	789
411	379	411	786	411	786
410	377	410	783	410	783
409	377	409	781	409	781
408	377	408	780	408	780
407	375	407	778	407	778
406	375	406	778	406	778
405	373	405	778	405	778
404	373	404	777	404	777
403	373	403	774	403	774
402	371	402	778	402	778
401	370	401	777	401	777
400	369	400	776	400	776
399	369	399	775	399	775
398	369	398	775	398	775
397	367	397	774	397	774
396	367	396	774	396	774
395	366	395	773	395	773
394	366	394	773	394	773
393	366	393	773	393	773
392	365	392	773	392	773
391	365	391	773	391	773
390	365	390	775	390	775
389	365	389	776	389	776
388	365	388	776	388	776
387	365	387	776	387	776

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Control No. P-SSAF-0003

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OSW/SQA/E Rev 6

# Wood Heater Test Data

U

Run: 6

Manufacturer: MF Fire  
 Model: Nova3C  
 Tracking No.: 2483  
 Project No.: 192765003E  
 Technician: 11024-29  
 Beginning Clock Time: 11:04:29

Total Sampling Time: 155 min  
 Recording Interval: 6 min  
 Total Volume: 24,943 cubic feet  
 Background Sample Volume: 24,943 cubic feet

PM Control Modules: 335,338  
 Dilution Tunnel MM(dry): 29.00  
 Dilution Tunnel MM(wet): 28.73  
 Dilution Tunnel Size: 2.00  
 Tunnel Area: 0.15835 ft<sup>2</sup>  
 Pilot Tube Cp: 0.59

Avg. Tunnel Velocity: 16.77 ft/sec.  
 Initial Tunnel Flow: 194.9 scfm  
 Average Chamber Flow: 194.9 scfm  
 Post-Test Leak Check (1): 0.003 cfm @ 5 in. Hg  
 Post-Test Leak Check (2): 0.003 cfm @ 7 in. Hg  
 Average Test Piece Fuel Moisture: 20.57% Dry Basis %

Technician Signature: \_\_\_\_\_

Meter Box Y Factor: 1.007 (1) 1.015 (2) 1.012 (Amb)	
Biometric Pressure:	Room Air Velocity: 27
Begin 29.99	End 29.96
Middle 29.98	Average 29.98

OMNI Equipment Numbers:

Velocity Traverse Data		Fuel Weight (lb)		Temperature Data (F)		Stack Gas Data		
PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8	Center
Initial dP	0.059	0.064	0.068	0.064	0.056	0.082	0.090	0.098
Temp:	127	127	128	128	127	127	126	126
V <sub>ave</sub>	18.75	ft/sec	V <sub>cent</sub>	21.84	ft/sec	F <sub>p</sub>	0.858	g/wg

Elapsed Time (min)	Particulate Sampling Data										Temperature Data (F)										Stack Gas Data											
	Gas Meter 1 (ft <sup>3</sup> )	Gas Meter 2 (ft <sup>3</sup> )	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH1 (H <sub>2</sub> O)	Meter 1 Temp (°F)	Meter 1 Vacuum (°Hg)	Orifice dH2 (H <sub>2</sub> O)	Meter 2 Temp (°F)	Meter 2 Vacuum (°Hg)	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 (Tot=At)	Catalyst Exit	Stack	Filter 1	Filter 2	Driver Exit 2	Ambient	Draft (H <sub>2</sub> O)	CO <sub>2</sub> (%)	CO (%)		
133	22.703	22.456	0.17	0.17	1.39	100	2.29	1.09	102	1.9	115	0.099	100	100	0.7	0	472	298	443	407	364	397	775	398	82	71	75	74	86	-0.043	5.38	0.01
134	22.876	22.627	0.17	0.17	1.39	100	2.29	1.10	102	1.8	115	0.098	100	100	0.6	-0.1	472	298	443	407	364	387	774	398	82	71	75	74	87	-0.043	5.4	0.01
135	23.047	22.797	0.17	0.17	1.39	101	2.29	1.10	102	1.9	115	0.098	99	99	0.6	0	471	299	444	407	364	387	772	397	82	71	76	74	87	-0.043	5.16	0.01
136	23.219	22.969	0.17	0.17	1.39	101	2.29	1.09	102	1.8	115	0.098	101	102	0.6	0	470	300	445	406	364	387	771	396	83	72	76	74	87	-0.042	5.13	0.01
137	23.392	23.140	0.17	0.17	1.39	101	2.29	1.09	102	1.9	115	0.097	101	101	0.6	0	469	300	444	406	364	387	770	396	83	72	77	74	87	-0.042	5.16	0.01
138	23.564	23.311	0.17	0.17	1.39	101	2.29	1.09	102	1.9	115	0.098	100	100	0.5	-0.1	469	301	445	405	363	387	771	396	83	72	77	74	87	-0.042	5.06	0.01
139	23.735	23.481	0.17	0.17	1.39	101	2.29	1.10	102	1.8	114	0.098	99	99	0.6	0.1	468	301	444	405	363	386	769	396	83	72	77	74	87	-0.042	4.93	0.01
140	23.908	23.652	0.17	0.17	1.39	101	2.29	1.09	102	1.9	114	0.099	99	99	0.5	-0.1	467	302	444	405	362	386	764	395	84	72	78	74	87	-0.042	4.83	0.01
141	24.081	23.823	0.17	0.17	1.39	101	2.29	1.09	102	1.9	115	0.100	99	99	0.5	0	466	302	443	404	362	385	763	395	84	72	78	74	87	-0.042	4.94	0.01
142	24.252	23.994	0.17	0.17	1.39	101	2.29	1.09	102	1.8	115	0.099	98	100	0.4	-0.1	465	302	443	404	362	395	759	394	84	73	78	74	87	-0.042	4.92	0.01
143	24.425	24.164	0.17	0.17	1.39	101	2.3	1.09	102	1.9	115	0.100	98	98	0.5	0.1	464	303	443	403	362	395	758	394	84	73	78	74	87	-0.042	4.94	0.01
144	24.597	24.336	0.17	0.17	1.39	101	2.29	1.09	102	1.9	114	0.101	98	99	0.4	-0.1	464	303	443	403	361	395	758	393	85	73	79	74	87	-0.042	4.96	0.01
145	24.769	24.507	0.17	0.17	1.39	101	2.29	1.09	102	1.9	115	0.100	98	99	0.4	0	463	303	443	403	361	394	758	393	85	73	79	74	87	-0.042	4.95	0.01
146	24.941	24.678	0.17	0.17	1.39	101	2.3	1.09	102	1.9	114	0.101	98	98	0.3	-0.1	462	303	443	402	361	394	757	392	85	73	79	74	87	-0.042	4.97	0.01
147	25.114	24.848	0.17	0.17	1.39	101	2.3	1.09	102	1.8	114	0.099	99	99	0.3	0	462	303	442	401	360	394	757	392	85	73	79	75	87	-0.042	4.96	0.01
148	25.286	25.018	0.17	0.17	1.39	101	2.3	1.09	102	1.9	115	0.098	100	99	0.3	0	462	304	443	401	359	394	756	390	85	73	80	75	88	-0.042	4.95	0.02
149	25.457	25.189	0.17	0.17	1.39	101	2.29	1.09	102	1.9	114	0.100	98	99	0.3	0	461	304	443	400	359	393	756	391	85	73	80	75	88	-0.042	4.94	0.02
150	25.630	25.360	0.17	0.17	1.39	101	2.3	1.09	102	1.9	114	0.098	100	100	0.2	-0.1	461	304	444	399	358	393	754	390	85	73	80	75	87	-0.042	4.89	0.01
151	25.803	25.531	0.17	0.17	1.39	101	2.29	1.09	102	1.9	114	0.099	99	99	0.2	0	460	304	445	399	357	393	753	391	86	73	80	75	88	-0.042	4.87	0.01
152	25.974	25.702	0.17	0.17	1.39	101	2.29	1.09	102	1.9	114	0.099	98	99	0.2	0	459	304	446	398	357	393	753	390	86	74	81	75	88	-0.042	4.59	0.02
153	26.147	25.873	0.17	0.17	1.39	101	2.3	1.09	102	1.9	114	0.098	100	100	0.2	0	458	304	446	398	357	393	753	390	86	74	81	75	88	-0.042	4.56	0.02
154	26.319	26.044	0.17	0.17	1.39	101	2.3	1.09	102	1.9	114	0.099	99	99	0.1	-0.1	458	304	446	398	356	392	753	390	86	74	81	75	88	-0.042	4.55	0.02
155	26.491	26.215	0.17	0.17	1.39	101	2.3	1.09	102	1.9	114	0.098	99	100	0.0	-0.1	456	304	447	397	356	392	751	390	86	74	81	75	88	-0.043	4.48	0.02



## Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire \_\_\_\_\_ Equipment Numbers: \_\_\_\_\_  
 Model: NovaC \_\_\_\_\_  
 Tracking No.: 2468 \_\_\_\_\_  
 Project No.: 0552WS003E \_\_\_\_\_  
 Run #: 6 \_\_\_\_\_  
 Date: 8/15/23 \_\_\_\_\_

**First Hour**

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

Total Particulate, mg:	0.0
------------------------	-----

**TRAIN 1**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	F46	126.6	123.3	3.3
C. Rear filter catch	Filter	F47	123.6	123.6	0.0
D. Probe catch*	Probe	74	117665.3	117665.2	0.1
E. Filter seals catch*	Seals	5560	4121.3	4120.6	0.7

Total Particulate, mg:	4.1
------------------------	-----

**TRAIN 2**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	F48	128.8	124.9	3.9
B. Rear filter catch	Filter	F49	123.2	123.0	0.2
C. Probe catch*	Probe	81	111860.5	111860.5	0.0
D. Filter seals catch*	Seals	5561	3348.7	3348.6	0.1

Total Particulate, mg:	4.2
------------------------	-----

**AMBIENT**

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch*	Filter	F50	125.2	125.1	0.1

Total Particulate, mg:	0.1
------------------------	-----

\*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: \_\_\_\_\_

## Run 6 First Hour Emissions Data

# Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire  
 Model: NovaC  
 Project No.: 0552WS003E  
 Tracking No.: 2468  
 Run: 6  
 Test Date: 08/15/23

Technician Signature: \_\_\_\_\_

Burn Rate  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	<p style="text-align: center;"><b>4.44 kg/hr dry</b></p> 133 degrees Fahrenheit 18.86 feet/second 11644.2 dscf/hour  0.098 inches H2O 60 minutes
--	---

	AMBIENT		SAMPLE TRAIN 1		SAMPLE TRAIN 2		FIRST HOUR FILTER (TRAIN 1)	
Total Sample Volume - Vm	24.943	cubic feet	9.590	cubic feet	0.000	cubic feet	9.590	cubic feet
Average Gas Meter Temperature	88	degrees Fahrenheit	87	degrees Fahrenheit	#DIV/0!	degrees Fahrenheit	87	degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmst	24.353	dscf	9.451	dscf	#DIV/0!	dscf	9.451	dscf
Total Particulates - m <sub>p</sub>	0	mg	0	mg	0	mg	5	mg
Particulate Concentration (dry-standard) - C <sub>p</sub> /C <sub>s</sub>	0.000000	grams/dscf	0.00000	grams/dscf	#DIV/0!	grams/dscf	0.00053	grams/dscf
Total Particulate Emissions - E <sub>T</sub>	0.00	grams	0.00	grams	#DIV/0!	grams	6.16	grams
Particulate Emission Rate	0.00	grams/hour	0.00	grams/hour	#DIV/0!	grams/hour	6.16	grams/hour
Emissions Factor		grams/kg	0.00	g/kg	#DIV/0!	g/kg	1.84	g/kg
Difference from Average Total Particulate Emissions			#DIV/0!	grams				
<b>Final Average Results</b>								
<b>Complete Test Run</b>								
Total Particulate Emissions - E <sub>T</sub>	#DIV/0!	grams	Filter Temps, °F	< 90	First Hour	Train 1	Train 2	Complies?
Particulate Emission Rate	#DIV/0!	grams/hour	Filter Face Velocity, fpm	< 30	86	86	0	OK
Emissions Factor	#DIV/0!	grams/kg	Dryer Exit Temp, °F	< 80	8.68	8.68	0.00	OK
			Leakage Rate, cfm	0.01	75	75	0	OK
			< 4% of avg sample rate or		0.000	0.001	0.000	OK
			< 0.01 cfm, lesser of the two		0.1	0	0	OK
			Neg. Probe Weight	=> 0	1.67%	1.67%	#DIV/0!	#DIV/0!
<b>First Hour Emissions</b>			Pro-Rate Variation	> 110 for < 10% of θ	0.00%	0.00%	#DIV/0!	#DIV/0!
Total Particulate Emissions - E <sub>T</sub>	6.16	grams	# Readings < 80%	# Readings > 120%	0	0	0	OK
Particulate Emission Rate	6.16	grams/hour	Ambient Temp, °F	< 55	0	0	0	OK
Emissions Factor	1.84	grams/kg	(min / max)	> 90				OK
7.5% of Average Total Particulate Emissions	#DIV/0!	grams	Train Precision	(A) Within 7.5%	87	89		OK
			One of A or B must	(B) Within 0.5 g/kg	#DIV/0!	#DIV/0!		#DIV/0!
			Stove Surface ΔT	Within 125 °F	53	53		OK
			Room Air Velocity	< 50 fpm	27	27		OK



Run: 6

Manufacturer: MF Fire
Model: Nova3C
Tracking No.: 2493
Project No.: 10276500E
Tester: 1104-29

Total Sampling Time: 69 min
Recording Interval: 6 min
Total Sample Volume: 24,943 cubic feet

Background Sample Volume: 24,943 cubic feet

Meter Box Y Factor: 1.014 (1) 1.015 (2) 1.012 (Amb)

Biometric Pressure: Begin Middle End Average
29.99 29.96 29.98 27

OMNI Equipment Numbers:

Wood Heater Test Data

PM Control Modules: 371.338
Dilution Tunnel MM(dry): 29.00
Dilution Tunnel MM(wet): 28.73
Dilution Tunnel SHC: 2.00
Dilution Tunnel Area: 0.18335 ft2
Tunnel Area: 0.18335 ft2
Plot Tube Cp: 0.59

Avg. Tunnel Velocity: 18.86 ft/sec.
Initial Tunnel Flow: 194.9 scfm.
Avg. Weight Change: 0.0004 lbm.
Post-Test Leak Check (1): 0.003 cfm @ 5 in. Hg
Post-Test Leak Check (2): 0.003 cfm @ 7 in. Hg
Average Test Piece Fuel Moisture: 20.57% Dry Basis %

Velocity Traverse Data table with columns: P1.1, P1.2, P1.3, P1.4, P1.5, P1.6, P1.7, P1.8, Center, Initial dp, Temp.

Velocity Traverse Data
Vavg 18.75 ft/sec
Vstart 21.84 ft/sec
Fp 0.858

Technician Signature:

Export to PDF

Main data table with columns: Elapsed Time (min), Gas Meter 1 (ft3), Gas Meter 2 (ft3), Sample Rate 1 (cfm), Sample Rate 2 (cfm), Particulate Sampling Data (Meter 1 Temp, Vacuum, Office dH2O, dH2O Temp, Meter 2 Vacuum), Dilution Tunnel (Center dp, Pro. Rate Pro. Rate 2, Weight Change, Fuel Weight (lb), Scale Reading, Pro. Rate), Temperature Data (F) (Avg. Stove Surface, Catalyst Exit, Stack, Filter 1, Filter 2, Driver Exit 1, Driver Exit 2, Ambient), Stack Gas Data (Draift (H2O), CO2 (%), CO (%)).

## Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire	Equipment Numbers: _____
Model: NovaC	_____
Tracking No.: 2468	_____
Project No.: 0552WS003E	_____
Run #: 6	
Date: 8/15/23	

**First Hour**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	F44	129.8	124.9	4.9
C. Rear filter catch	Filter	F45	123.2	123.2	0.0
D. Probe catch*	Probe	32	114743.2	114743.1	0.1
E. Filter seals catch*	Seals	S559	3389.1	3389.1	0.0

Total Particulate, mg:	5.0
------------------------	-----

**TRAIN 1**

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

Total Particulate, mg:	0.0
------------------------	-----

**TRAIN 2**

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

Total Particulate, mg:	0.0
------------------------	-----

**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: \_\_\_\_\_

# OMNI-Test Laboratories

**Manufacturer:** MF Fire  
**Model:** Nova C  
**Date:** 08/15/23  
**Run:** 6  
**Control #:** 3468  
**Test Duration:** 155  
**Output Category:** SBR

**Technicians:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## Test Results in Accordance with CSA B415.1-10

	HHV Basis	LHV Basis
Overall Efficiency	69.5%	75.1%
Combustion Efficiency	98.0%	98.0%
Heat Transfer Efficiency	71%	76.6%

Output Rate (kJ/h)	23,654	22,438	(Btu/h)
Burn Rate (kg/h)	1.72	3.79	(lb/h)
Input (kJ/h)	34,052	32,302	(Btu/h)

Test Load Weight (dry kg)	4.44	9.79	dry lb
MC wet (%)	17.06		
MC dry (%)	20.57		
Particulate (g)	4.86		
CO (g)	143		
Test Duration (h)	2.58		

Emissions	Particulate	CO
g/MJ Output	0.08	2.33
g/kg Dry Fuel	1.09	32.10
g/h	1.88	55.17
lb/MM Btu Output	0.18	5.42

Air/Fuel Ratio (A/F)	14.56
----------------------	-------

VERSION:

2.4

4/15/2010

VERSION: 2.4 4/15/2010

Manufacturer: MF Fire  
 Model: Nova C  
 Date: 8/15/2023  
 Run: 6  
 Control #: 3468  
 Test Duration: 155  
 Output Category: SBR

Appliance Type: Cat (Cat, Non-Cat, Pellet)

Temp. Units F (F or C)  
 Weight Units lb (kg or lb)

Default Fuel Values  
 D. Fir Oak  
 HHV (kJ/kg) 19,810 19,887  
 %C 48.73 50  
 %H 6.87 6.6  
 %O 43.9 42.9  
 %Ash 0.5 0.5

Wood Moisture (% wet): 17.06  
 Load Weight (lb wet): 11.80  
 Burn Rate (dry kg/h): 1.72  
 Total Particulate Emissions: 4.86 g

Fuel Data  
 D. Fir  
 HHV 19,810 kJ/kg  
 %C 48.73  
 %H 6.87  
 %O 43.9  
 %Ash 0.5

Note 1: For other fuels, use the heating value and fuel composition determined by analysis of fuel sample in accordance with Clause 9.2.

Averages 0.15 7.35 #DIV/0! 468.15 87.63

Elapsed Time (min)	Fuel Weight Remaining (lb)	Flue Gas Composition (%)			Temp. (°F)	
		CO	CO <sub>2</sub>	O <sub>2</sub>	Flue Gas	Room Temp
0	11.80	0.20	1.65		426.0	88.0
1	11.80	0.25	1.22		396.0	88.0
2	11.80	0.03	3.35		419.0	88.0
3	11.70	0.04	4.33		438.0	87.0
4	11.50	0.04	7.26		457.0	87.0
5	11.30	0.82	11.16		478.0	87.0
6	11.00	0.56	11.20		498.0	88.0
7	10.80	0.13	10.10		502.0	87.0
8	10.60	0.05	8.85		499.0	87.0
9	10.40	0.17	10.46		506.0	87.0
10	10.10	0.64	11.29		520.0	87.0
11	9.90	0.67	11.09		530.0	87.0
12	9.70	0.36	10.75		530.0	87.0
13	9.50	0.58	11.06		535.0	87.0
14	9.30	0.64	11.32		538.0	87.0
15	9.10	0.72	11.28		543.0	87.0
16	8.90	0.69	11.28		546.0	87.0
17	8.70	0.66	11.26		548.0	87.0
18	8.50	0.65	11.41		550.0	87.0
19	8.30	0.65	11.28		554.0	88.0
20	8.10	0.65	11.36		553.0	88.0
21	7.90	0.72	11.52		557.0	88.0
22	7.70	0.73	11.53		560.0	89.0
23	7.60	0.68	11.56		562.0	89.0
24	7.40	0.69	11.59		564.0	89.0
25	7.20	0.68	11.58		566.0	89.0
26	7.00	0.63	11.43		567.0	89.0
27	6.80	0.66	11.29		565.0	89.0
28	6.70	0.64	11.18		568.0	89.0
29	6.50	0.65	11.26		569.0	89.0
30	6.40	0.68	11.24		569.0	88.0
31	6.20	0.69	11.39		566.0	89.0
32	6.00	0.56	11.21		569.0	89.0
33	5.90	0.56	11.34		568.0	89.0
34	5.70	0.67	11.45		568.0	89.0
35	5.60	0.63	11.38		567.0	89.0
36	5.40	0.54	11.38		569.0	89.0
37	5.30	0.41	11.15		566.0	88.0
38	5.10	0.30	11.00		566.0	89.0
39	5.00	0.26	10.92		566.0	88.0
40	4.90	0.21	10.81		565.0	89.0
41	4.80	0.15	10.79		565.0	89.0
42	4.70	0.10	10.58		560.0	89.0
43	4.50	0.08	10.41		556.0	88.0
44	4.40	0.07	10.35		554.0	88.0
45	4.30	0.07	10.39		551.0	88.0
46	4.20	0.05	10.33		547.0	88.0
47	4.10	0.06	10.30		546.0	88.0
48	4.00	0.11	10.41		546.0	88.0
49	3.90	0.11	10.5		545	88
50	3.80	0.16	10.51		544	88
51	3.60	0.15	10.41		543	88
52	3.50	0.11	10.09		543	88
53	3.50	0.05	9.55		541	88
54	3.30	0.04	9.07		536	88

Note 2: In cases where the "Fuel Weight Remaining" is the same for three or more readings in a row, a "divide by zero error" will occur in the calculation sheet. In such cases, adjust the weight values by interpolation between the first occurrence and the next reading showing a decrease in weight.



55	3.30	0.03	8.64	532	88
56	3.20	0.02	8.33	528	88
57	3.10	0.01	8.13	524	88
58	3.00	0	7.85	519	88
59	3.00	0	7.7	515	88
60	2.90	0	7.62	513	89
61	2.90	0	7.52	508	89
62	2.80	0	7.45	504	89
63	2.80	0	7.35	499	88
64	2.70	0	7.28	496	87
65	2.60	0	7.24	495	87
66	2.60	0	7.15	490	87
67	2.50	0	7.11	486	87
68	2.50	0	7	484	87
69	2.40	0	6.94	482	87
70	2.40	0	6.87	478	87
71	2.30	0	6.8	475	87
72	2.30	0	6.73	474	87
73	2.20	0.01	6.7	473	87
74	2.20	0.01	6.66	470	87
75	2.10	0.01	6.67	467	87
76	2.10	0.01	6.68	466	87
77	2.10	0.01	6.69	464	87
78	2.10	0.01	6.68	463	88
79	2.00	0.01	6.7	461	87
80	2.00	0.01	6.61	459	87
81	1.90	0.01	6.5	459	87
82	1.90	0.01	6.41	456	87
83	1.80	0.01	6.34	454	87
84	1.80	0.01	6.15	452	88
85	1.80	0.01	5.55	447	87
86	1.80	0.01	5.42	445	87
87	1.80	0.01	5.35	442	87
88	1.70	0.01	5.33	440	87
89	1.70	0.01	5.27	440	87
90	1.70	0.01	5.21	437	87
91	1.60	0.01	5.23	436	87
92	1.60	0.01	5.27	435	88
93	1.60	0.01	5.29	432	88
94	1.60	0.01	5.31	431	87
95	1.60	0.01	5.29	428	87
96	1.50	0.01	5.27	426	88
97	1.50	0.01	5.28	424	87
98	1.50	0.01	5.32	422	88
99	1.40	0.01	5.33	421	88
100	1.40	0.01	5.3	420	87
101	1.40	0.01	5.31	418	87
102	1.40	0.01	5.37	416	87
103	1.40	0.01	5.36	414	87
104	1.40	0.01	5.36	414	87
105	1.30	0.01	5.38	412	87
106	1.30	0.01	5.41	411	88
107	1.30	0.01	5.41	410	87
108	1.20	0.01	5.42	410	88
109	1.20	0.01	5.45	409	88
110	1.20	0.01	5.41	407	88
111	1.20	0.01	5.18	407	88
112	1.20	0.01	5.11	406	87
113	1.20	0.01	5.11	405	88
114	1.10	0.01	5.12	405	89
115	1.10	0.01	5.34	403	88
116	1.10	0.01	5.4	403	88
117	1.00	0.01	5.44	402	88
118	1.00	0.01	5.49	403	88
119	1.00	0.01	5.49	402	88
120	1.00	0.01	5.5	403	88
121	1.00	0.01	5.51	403	88
122	0.90	0.01	5.53	402	89
123	1.00	0.01	5.55	401	88
124	0.90	0.01	5.44	401	88
125	0.80	0.01	5.4	398	88
126	0.80	0.01	5.4	396	88
127	0.80	0.01	5.48	398	86
128	0.80	0.01	5.49	399	86

129	0.80	0.01	5.47		399	86
130	0.80	0.01	5.44		399	86
131	0.70	0.01	5.41		399	86
132	0.70	0.01	5.4		398	86
133	0.70	0.01	5.38		398	86
134	0.60	0.01	5.4		398	87
135	0.60	0.01	5.16		397	87
136	0.60	0.01	5.13		396	87
137	0.60	0.01	5.16		396	87
138	0.50	0.01	5.06		396	87
139	0.60	0.01	4.93		396	87
140	0.50	0.01	4.93		395	87
141	0.50	0.01	4.94		395	87
142	0.40	0.01	4.92		394	87
143	0.50	0.01	4.94		394	87
144	0.40	0.01	4.96		393	87
145	0.40	0.01	4.95		393	87
146	0.30	0.01	4.97		392	87
147	0.30	0.01	4.96		392	87
148	0.30	0.02	4.95		390	88
149	0.30	0.02	4.94		391	88
150	0.20	0.01	4.89		390	87
151	0.20	0.01	4.87		391	88
152	0.20	0.02	4.59		390	88
153	0.20	0.02	4.56		390	88
154	0.10	0.02	4.55		390	88
155	0.00	0.02	4.48		390	88

### ASTM E2780 Wood Heater Run Sheets

Client: MF Fire Project Number: 0552WS003E Run Number: 6  
 Model: Small Tracking Number: \_\_\_\_\_ Date: 08/15/2023  
 Test Crew: R Tiegs  
 OMNI Equipment ID numbers: \_\_\_\_\_

#### Wood Heater Run Notes

##### Air Control Settings

Primary:

FIXED (SBR)

Secondary: N/A

Tertiary/Pilot: N/A

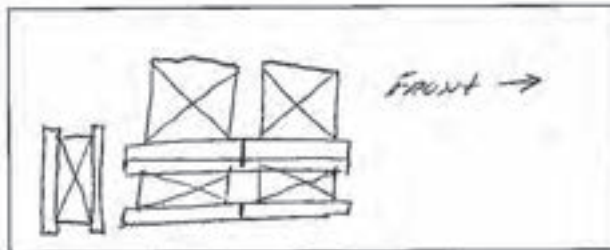
Fan: N/A

##### Preburn Notes

Time	Notes
0843	Pre burn fuel loaded at 2.4 lbs
0943	Missed coal bed range
0950	Additional pre burn fuel moisture 20.1, 19.9, 20.1
1053	At 68 min added additional 8.4 lbs
1102	PB stopped

##### Test Notes

Sketch test fuel configuration:



Start up procedures & Timeline:

Bypass: Used  
 Fuel loaded by: 60  
 Door closed at: 65  
 Primary air: N/A

Notes: \_\_\_\_\_

Time	Notes
1104	TEST start
1204	1st hour sampling stopped
1339	test done
1406	Bias check nitrogen O: 0.01, ppm: 1 CO: 0.003, CO <sub>2</sub> 0.02

Technician Signature: R Tiegs

Date: 08-15-2023

### ASTM E2780 Wood Heater Run Sheets

Client: MF Fire Project Number: 0552WS003E Run Number: 6  
 Model: Small Tracking Number: \_\_\_\_\_ Date: 08/15/2023  
 Test Crew: R Tiegs  
 OMNI Equipment ID numbers: \_\_\_\_\_

#### Wood Heater Supplemental Data

Start Time: 1104 Booth #: \_\_\_\_\_  
 Stop Time: 1339

**Stack Gas Leak Check:**

Initial:  Final:

**Sample Train Leak Check:**

A: 0.001 @ 8.7"Hg  
 B: 0.000 @ 7.1"Hg  
 1st hour 0.000 5.00

Calibrations: Span Gas CO<sub>2</sub>: 16.84 CO: 4.38 ppm 500

	Pre Test		Post Test	
	Zero	Span	Zero	Span
Time	<u>0756</u>	<u>0758</u>	<u>1400</u>	<u>1401</u>
CO <sub>2</sub>	<u>0.00</u>	<u>16.84</u>	<u>0.00</u>	<u>16.81</u>
CO	<u>0.00</u>	<u>4.379</u>	<u>0.003</u>	<u>4.379</u>
ppm	<u>0</u>	<u>500</u>	<u>0</u>	<u>497</u>

Air Velocity (ft/min): Initial: 4ft Final: 27  
 Scale Audit (lbs): Initial: 10.0 Final: 10.0  
 Pitot Tube Leak Test: Initial:  Final:   
 Stack Diameter (in): 6  
 Induced Draft: None  
 % Smoke Capture: 100  
 Flue Pipe Cleaned Prior to First Test in Series:  
 Date: See Run 1 Initials: Rt

Tunnel Traverse			
	Microtector Reading	dP (in H <sub>2</sub> O)	T(°F)
	<u>-0.099</u>	<u>-0.098</u>	<u>126</u>
1	<u>-0.029</u>	<u>-0.058</u>	<u>127</u>
2	<u>-0.043</u>	<u>-0.086</u>	<u>127</u>
3	<u>-0.044</u>	<u>-0.088</u>	<u>128</u>
4	<u>0.032</u>	<u>-0.064</u>	<u>128</u>
1	<u>-0.028</u>	<u>-0.056</u>	<u>127</u>
2	<u>-0.041</u>	<u>-0.082</u>	<u>127</u>
3	<u>-0.045</u>	<u>-0.090</u>	<u>127</u>
4	<u>-0.029</u>	Center:	
4	<u>-0.029</u>	<u>-0.058</u>	<u>126</u>

	Initial	Middle	Ending
P <sub>b</sub> (in/Hg)	<u>29.99</u>	/	<u>29.96</u>
RH (%)	<u>47</u>	/	<u>40</u>
Ambient (°F)	<u>85</u>	/	<u>87</u>

Background Filter Volume: 24.943

Tunnel Static Pressure (in H <sub>2</sub> O):	
Beginning of Test	End of Test
<u>-0.37</u>	<u>-0.37</u>

Technician Signature: [Signature]

Date: 8/15/2023

201.5  
177 = 118.529

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**  
Client: MF Fire Project Number: 0552WS003E Run Number: 6  
Model: Small Tracking Number: \_\_\_\_\_ Date: 08/15/2023  
Test Crew: R Tiegs  
OMNI Equipment ID numbers: \_\_\_\_\_

**Wood Heater Fuel Data**

Fuel: Douglas fir, untreated and air dried, standard grade or better dimensional lumber

**Pre-Burn Fuel**

Calibration: Cal Value (1) = 12% Actual Reading 12.0  
Cal Value (2) = 22% Actual Reading 22.0

Piece:	Length:	Reading:	Piece:	Length:	Reading:
1	<u>14</u> in	<u>22.6</u>	7	<u>14</u> in	<u>22.2</u>
2	<u>14</u> in	<u>23.0</u>	8	<u>5</u> in	<u>23.3</u>
3	<u>10</u> in	<u>22.0</u>	9	_____ in	_____
4	<u>10</u> in	<u>21.7</u>	10	_____ in	_____
5	<u>10</u> in	<u>22.5</u>	11	_____ in	_____
6	<u>14</u> in	<u>22.0</u>	12	_____ in	_____

Total Pre-Burn Fuel Weight: 8.4/lbs Pre-Burn Fuel Average Moisture: \_\_\_\_\_  
Time (clock): 0712 Room Temperature (F): 81 Initials: RT

**Test Fuel**

Firebox Volume (ft³): 1.70 Test Fuel Piece Length (in): 14  
Load Weight Range (lb): 2.4-2.9 K Total Wet Fuel Load Weight (lb): 11.8  
10.8-13.0

Fuel Type & Amount: 2 x 4: 3 4 x 4: 2 20.57% db  
Weight (with spacers): 5.2 Weight (with spacers): 6.6

Piece:	Weight (lbs):	Moisture Readings (%DB):			Fuel Type:
1	<u>3.0 / 2.8</u>	<u>24.9</u>	<u>20.1</u>	<u>22.1</u>	<u>4x4</u>
2	<u>3.6 / 3.4</u>	<u>22.4</u>	<u>21.9</u>	<u>21.0</u>	<u>4x4</u>
3	<u>1.7 / 1.4</u>	<u>25.0</u>	<u>21.6</u>	<u>24.9</u>	<u>2x4</u>
4	<u>1.7 / 1.4</u>	<u>22.0</u>	<u>21.6</u>	<u>22.3</u>	<u>2x4</u>
5	<u>1.7 / 1.4</u>	<u>23.1</u>	<u>22.2</u>	<u>22.0</u>	<u>2x4</u>
6	_____	_____	_____	_____	_____
7	_____	_____	_____	_____	_____

**Spacer Moisture Readings (%DB)**

<u>8.3</u>	<u>8.2</u>	<u>7.5</u>	<u>8.0</u>	_____	_____	_____	_____
<u>7.9</u>	<u>8.1</u>	<u>8.0</u>	<u>8.3</u>	_____	_____	_____	_____
<u>7.5</u>	<u>8.2</u>	<u>7.7</u>	<u>8.8</u>	_____	_____	_____	_____
<u>7.9</u>	<u>8.0</u>	<u>7.7</u>	<u>8.1</u>	_____	_____	_____	_____

Time (clock): 0742 Room Temperature (F): 81 Initials: RT

Technician Signature: R Tiegs Date: 8-15-2023

### ASTM E2780 Wood Heater Run Sheets

Client: MF Fire Project Number: 0552WS003E Run Number: 6  
 Model: Small Tracking Number: \_\_\_\_\_ Date: 08/15/2023  
 Test Crew: R Tieg  
 OMNI Equipment ID numbers: \_\_\_\_\_

#### ASTM E2515 Lab Sheet

Assembled By:

Riley Tieg

Date/Time in Dessicator:

08-15-2023 1415

Weighing #1	Weighing #2	Weighing #3	Weighing #4	Weighing #5
Date/Time: <u>1415 8.15.23</u>	Date/Time: <u>1431 8.16.23</u>	Date/Time: <u>7:10 8.17.23</u>	Date/Time: <u>7:36 8.21.23</u>	Date/Time:
R/H %: <u>24.4</u>	R/H %: <u>12.8</u>	R/H %: <u>14.2</u>	R/H %: <u>9.4</u>	R/H %:
Temp: <u>81.3</u>	Temp: <u>80.2</u>	Temp: <u>80.7</u>	Temp: <u>77.6</u>	Temp:
200 mg Audit: <u>200.0</u>	200 mg Audit: <u>200.1</u>	200 mg Audit: <u>200.0</u>	200 mg Audit: <u>200.0</u>	200 mg Audit:
2 g Audit: <u>2000.2</u>	2 g Audit: <u>2000.3</u>	2 g Audit: <u>2000.2</u>	2 g Audit: <u>2000.2</u>	2 g Audit:
100 g Audit: <u>99998.0</u>	100 g Audit: <u>99998.1</u>	100 g Audit: <u>99998.1</u>	100 g Audit: <u>99998.1</u>	100 g Audit:
Initials: <u>RT</u>	Initials: <u>K</u>	Initials: <u>K</u>	Initials: <u>K</u>	Initials:

Train	Element	ID #	Tare (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)
A (First Hour)	Front Filter	F44	124.9 ✓	129.9	129.8	129.8	—	
	Rear Filter	F45	123.2 ✓	123.4	123.2	123.2	—	
	Probe	32	114243.1 ✓	114743.2	114743.5	114743.4	114743.2	—
	O-Ring Set	5559	3389.1 ✓	3392.9	3389.0	3389.1	—	
A (Remainder)	Front Filter	F46	123.3 ✓	126.7	126.6	126.6	—	
	Rear Filter	F47	123.6 ✓	123.6	123.6	123.6	—	
	Probe	74	117665.2 ✓	117665.3	117665.6	117665.4	117665.3	—
	O-Ring Set	5560	4120.6 ✓	4124.4	4121.8	4121.4	4121.3	—
B	Front Filter	F48	124.9 ✓	128.9	128.8	128.8	—	
	Rear Filter	F49	123.0 ✓	123.4	123.3	123.2	—	
	Probe	81	111860.5 ✓	111860.6	111860.9	111860.5	—	
	O-Ring Set	5561	3348.6 ✓	3351.8	3348.4	3348.7	3348.7	—
BG	Filter	F50	125.1 ✓	125.0	125.1	125.2	—	

Technician Signature: Riley Tieg

Date: 9-27-23

*MF Fire, Inc.  
Model: Nova C  
0552WS003E*

## Tares

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

Prepared By: R. Ley Tieg Balance ID #: \_\_\_\_\_ Thermohyrometer ID #: \_\_\_\_\_ Audit Weight ID #/Mass: \_\_\_\_\_

Placed in Dessicator: Date: <u>06-12-22</u> Time: <u>0900</u>	Date: <u>6-15-23</u>		Date: <u>06-19-23</u>		Date: _____		Date: _____		Date Used	Project Number	Run No.
	Time: <u>1230</u>	Time: <u>1440</u>	Time: _____	Time: _____	Time: _____	Time: _____	Time: _____	Time: _____			
Time: <u>0900</u>	RH %: <u>180</u>	RH %: <u>1900</u>	RH %: _____	RH %: _____	RH %: _____	RH %: _____	RH %: _____	RH %: _____			
Time: <u>0900</u>	T (°F): <u>75.1</u>	T (°F): <u>75.1</u>	T (°F): _____	T (°F): _____	T (°F): _____	T (°F): _____	T (°F): _____	T (°F): _____			
ID #	Audit: <u>199.9</u>	Audit: <u>205.0</u>	Audit: _____	Audit: _____	Audit: _____	Audit: _____	Audit: _____	Audit: _____			
E981	117.7	117.9 ✓							6-21-23		
E982	118.9	118.9 ✓									4
E983	117.4	117.6 ✓							7-11-23	05265003E	1
E984	119.3	119.2									
E985	118.2	118.3 ✓									
E986	118.3	118.3 ✓									
E987	117.8	117.9 ✓									
E988	118.1	118.1 ✓									
E989	117.6	117.7 ✓									
E990	118.3	118.2 ✓							7-12-23		2
E991	117.8	117.9 ✓									
E992	118.4	118.4 ✓									
E993	117.8	118.0 ✓									
E994	118.6	118.7 ✓									
E995	117.9	117.9 ✓									
E996	117.5	117.7 ✓									
E997	118.4	118.5 ✓									
E998	118.1	118.1 ✓									3
E999	118.1	118.2 ✓									
F006	117.7	117.6									

Final Technician Signature: \_\_\_\_\_ Date: 07/21/2023  
 Control No. P-SFDP-0002.xls, Effective date: 2/1/2017  
 Evaluator signature: [Signature]  
 Initials: RD Initials: RD



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

Prepared By: P. Ley Tieg Balance ID #: \_\_\_\_\_ Thermohyrometer ID #: \_\_\_\_\_ Audit Weight ID #/Mass: \_\_\_\_\_

Placed In Dessicator: Date: <u>06-12-23</u> Time: <u>0900</u>	Date: <u>6-15-23</u>		Date: <u>7-12-23</u>		Date: _____		Date Used	Project Number	Run No.
	Time: <u>1738</u>	Time: <u>1148</u>	Time: _____	Time: _____	Time: _____	Time: _____			
	RH %: <u>19.0</u>	RH %: <u>36.210</u>	RH %: _____	RH %: _____	RH %: _____	RH %: _____			
	T (°F): <u>75.1</u>	T (°F): <u>81.0</u>	T (°F): _____	T (°F): _____	T (°F): _____	T (°F): _____			
ID #	Audit: <u>199.9</u>	Audit: <u>199.9</u>	Audit: _____	Audit: _____	Audit: _____	Audit: _____			
F001	<u>118.2</u>	<u>118.1</u> ✓					<u>7-12-2023</u>	<u>0552 W5003E</u>	<u>3</u>
F002	<u>117.8</u>	<u>117.4</u>							
F003	<u>118.5</u>	<u>118.3</u> ✓					<u>7-12-2023</u>	<u>0552 W5003E</u>	<u>3</u>
F004	<u>118.4</u>	<u>118.2</u> ✓					↓	↓	↓
F005	<u>118.0</u>	<u>118.0</u> ✓					<u>7-13-23</u>		<u>4</u>
F006	<u>117.5</u>	<u>117.3</u> ✓							
F007	<u>117.3</u>	<u>117.4</u> ✓							
F008	<u>117.1</u>	<u>117.1</u> ✓							
F009	<u>116.2</u>	<u>116.2</u> ✓							
F010	<u>117.4</u>	<u>117.4</u> ✓							
F011	<u>116.4</u>	<u>116.4</u> ✓							
F012	<u>115.9</u>	<u>115.9</u> ✓					↓	↓	↓
F013	<u>117.5</u>	<u>117.6</u> ✓					<u>7-17-23</u>		<u>6</u>
F014	<u>116.3</u>	<u>116.4</u> ✓							
F015	<u>117.4</u>	<u>117.4</u> ✓							
F016	<u>116.7</u>	<u>116.9</u> ✓							
F017	<u>116.8</u>	<u>116.8</u> ✓							
F018	<u>116.2</u>	<u>116.2</u> ✓							
F019	<u>118.0</u>	<u>118.1</u> ✓					↓	↓	↓
F020	<u>116.2</u>	<u>116.2</u> ✓							

Final Technician Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
 Control No. P-SFDP-0002.xls, Effective date: 2/1/2017  
 Evaluator signature: [Signature]

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

Prepared By: Tony Tong Balance ID #: 00637 Thermohygrometer ID #: 00709 Audit Weight ID #/Mass: 00283A / 200mg

ID #	Placed In				100mm Filters				Date Used	Project Number	Run No.
	Date:	Time:	RH %:	T (°F):	Date:	Time:	RH %:	T (°F):			
F41	07/18/23	16:30	21.7	78.9	07/20/23	7:30	17.9	78.0			
F42	07/17/23	16:00	21.7	78.9							
F43	07/18/23	16:30	21.7	78.9							
F44	07/18/23	16:30	21.7	78.9							
F45	07/18/23	16:30	21.7	78.9							
F46	07/18/23	16:30	21.7	78.9							
F47	07/18/23	16:30	21.7	78.9							
F48	07/18/23	16:30	21.7	78.9							
F49	07/18/23	16:30	21.7	78.9							
F50	07/18/23	16:30	21.7	78.9							
F51	07/18/23	16:30	21.7	78.9							
F52	07/18/23	16:30	21.7	78.9							
F53	07/18/23	16:30	21.7	78.9							
F54	07/18/23	16:30	21.7	78.9							
F55	07/18/23	16:30	21.7	78.9							
F56	07/18/23	16:30	21.7	78.9							
F57	07/18/23	16:30	21.7	78.9							
F58	07/18/23	16:30	21.7	78.9							
F59	07/18/23	16:30	21.7	78.9							
F60	07/18/23	16:30	21.7	78.9							

Final Technician Signature: Tony Tong Date: 07/20/23  
 Control No. P-SFDP-0002.xls, Effective date: 2/17/2017  
 Evaluator signature: [Signature]

Tare Sheet: (check one)  Probes  47mm Filters  100mm Filters  O-Ring Pair   
 Prepared By: \_\_\_\_\_ Balance ID #: \_\_\_\_\_ Thermohygrometer ID #: \_\_\_\_\_ Audit Weight ID #/Mass: \_\_\_\_\_

Placed in Dessicator: Date: 6-29-23 Time: 0900	6-30-23		7-5-23		7-7-23		Date Used		Project Number	Run No.
	Date:	Time:	Date:	Time:	Date:	Time:	Date:	Time:		
	114751.3	117070.5	117508.51.3	117070.5	113570.2	112710.0	113570.2	112710.0	0552W5003E	2
	118127.6	118127.7	118127.7	118127.7	113570.2	112710.0	113570.2	112710.0	0552W5003E	2
	114370.4	116878.8	114370.2	116878.3	113570.2	112710.0	113570.2	112710.0	0552W5003E	2
	118455.5	118455.5	118455.3	118455.3	113570.2	112710.0	113570.2	112710.0	0552W5003E	2
	114284.9	114284.9	114284.4	114284.4	113570.2	112710.0	113570.2	112710.0	0552W5003E	2
	114329.1	113943.9	114328.5	113943.3	113570.2	112710.0	113570.2	112710.0	0552W5003E	2
	113570.9	113710.3	113570.0	113709.8	113570.2	112710.0	113570.2	112710.0	0552W5003E	2
	116834.0	116834.0	116834.0	116834.0	113570.2	112710.0	113570.2	112710.0	0552W5003E	2
	114466.4	114466.4	114466.2	114466.2	113570.2	112710.0	113570.2	112710.0	0552W5003E	2
	114884.0	118126.0	114883.8	118126.5	113570.2	112710.0	113570.2	112710.0	0552W5003E	2
	115596.3	115596.3	115595.8	115595.8	113570.2	112710.0	113570.2	112710.0	0552W5003E	2
	117662.7	117662.7	117662.4	117662.4	113570.2	112710.0	113570.2	112710.0	0552W5003E	2
	114562.5	114562.5	114561.8	114561.8	113570.2	112710.0	113570.2	112710.0	0552W5003E	2
	114362.7	114362.7	114362.5	114362.5	113570.2	112710.0	113570.2	112710.0	0552W5003E	2

Final Technician Signature: \_\_\_\_\_ Date: \_\_\_\_\_ Evaluator signature: \_\_\_\_\_  
 Control No. P-SFDP-0002.xls, Effective date: 2/1/2017

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

Prepared By: Filey Tieg Balance ID #: \_\_\_\_\_ Thermohygrometer ID #: \_\_\_\_\_ Audit Weight ID #/Mass: \_\_\_\_\_

Placed In Dessicator:	Date: <u>06-13-23</u>		Date: <u>06-15-23</u>		Date: _____		Date: _____		Date Used	Project Number	Run No.
	Time: <u>0800</u>	Time: <u>1545</u>	Time: _____	Time: _____	Time: _____	Time: _____	Time: _____	Time: _____			
Date: <u>06-12-23</u>	RH %: <u>24.8</u>	RH %: <u>16.6</u>	RH %: _____	RH %: _____	RH %: _____	RH %: _____	RH %: _____	RH %: _____			
Time: <u>0800</u>	T (°F): <u>75.9</u>	T (°F): <u>74.4</u>	T (°F): _____	T (°F): _____	T (°F): _____	T (°F): _____	T (°F): _____	T (°F): _____			
ID #	Audit: <u>9997.6</u>	Audit: <u>9998.7</u>	Audit: _____	Audit: _____	Audit: _____	Audit: _____	Audit: _____	Audit: _____			
78	117960.1	117460.0 ✓									1
17	114561.2	114561.5									1
81	11811859.8	11860.0 ✓									2
25	114299.5	114289.4 ✓									
32	114742.4	114742.3 ✓									
50	118125.7	118125.8 ✓									
61	118127.7	118127.8 ✓									
74	117664.8	117665.0 ✓									✓
62	117662.5	117662.6 ✓									✓
16	114266.5	114266.5 ✓									✓
31	114363.1	114363.0 ✓									✓
77	116180.7	116180.8 ✓									✓
8	115596.1	115596.2 ✓									✓
53	118272.4	118272.3 ✓									✓
35	114327.3	114377.4 ✓									✓
24	114128.4	114128.5 ✓									✓
13	114321.5	114321.5 ✓									✓
3	116011.5	116011.6 ✓									✓
27	114352.6	114352.4 ✓									✓
75	117637.8	117637.9									✓
	Initials: <u>PC</u>	Initials: <u>RT</u>	Initials: _____	Initials: _____	Initials: _____	Initials: _____	Initials: _____	Initials: _____			

Final Technician Signature: Filey Tieg Date: 06-15-23  
 Control No. P-SFDP-0002.xls, Effective date: 2/1/2017  
 Evaluator signature: John P. Meyer

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

Prepared By: Riley Tieg Balance ID #: 99997.9 Thermohyrometer ID #:          Audit Weight ID #/Mass:          /

Placed In Desiccator: Date: <u>08/15/23</u> Time: <u>12:05:09PM</u>	Date: <u>7-17-23</u> Time: <u>12:00</u> RH %: <u>16.4</u> T (°F): <u>77.5</u> Audit: <u>99997.9</u>	Date: <u>07/19/23</u> Time: <u>14:50</u> RH %: <u>16.9</u> T (°F): <u>78.4</u> Audit: <u>99997.9</u>	Date: <u>        </u> Time: <u>        </u> RH %: <u>        </u> T (°F): <u>        </u> Audit: <u>        </u>	Date: <u>        </u> Time: <u>        </u> RH %: <u>        </u> T (°F): <u>        </u> Audit: <u>        </u>	Date Used	Project Number	Run No.
68	116878.9	116878.8			[REDACTED]	[REDACTED]	[REDACTED]
28	114751.2	114751.2			[REDACTED]	[REDACTED]	[REDACTED]
3	116011.5	116011.3			[REDACTED]	[REDACTED]	[REDACTED]
8	115596.1	115596.1			[REDACTED]	[REDACTED]	[REDACTED]
25	114299.7	114299.6			[REDACTED]	[REDACTED]	[REDACTED]
32	114743.0	114743.1			<u>08-15-23</u>	<u>055205050</u>	<u>6</u>
74	117665.2	117665.2			↓	↓	↓
76	116961.5	116961.4			↓	↓	[REDACTED]
16	114266.7	114266.9					[REDACTED]
81	111860.6	111860.5			<u>08-15-23</u>	<u>055205050</u>	<u>36</u>
78	117461.0	117460.8			[REDACTED]	[REDACTED]	[REDACTED]
30	114328.7	114328.9			[REDACTED]	[REDACTED]	[REDACTED]
12	114284.8	114284.9					[REDACTED]
66	118455.7	118455.6					↓
33	11374.1	113944.0					↓
62	117662.7	117662.8			[REDACTED]	[REDACTED]	[REDACTED]

Final Technician Signature: Taryn Tieg Date: 07/19/2023 Initials: TT Initials:         

Control No. P-SFDP-0002.xls, Effective date: 2/1/2017

Evaluator signature: K. J. Morgan Initials:

Tare Sheet: (check one)

Prepared By: Tony Tong

Probes

Balance ID #: 00637

47mm Filters

Thermohyrometer ID #: 00709

100mm Filters

Audit Weight ID #/Mass: 0283A 15g

O-Ring Pair

Audit Weight ID #/Mass: 0283A 15g

Placed in Dessicator:	Date: <u>07/17/23</u>		Date: <u>07/18/23</u>		Date: <u>07/19/23</u>		Date: <u>07/20/23</u>		Project Number	Run No.
	Time: <u>15:00</u>	Time: <u>14:45</u>	Time: <u>14:30</u>	Time: <u>14:30</u>	Time: <u>7:30</u>	Time: <u>7:30</u>	Time: <u>7:30</u>	Time: <u>7:30</u>		
Date: <u>06/29/23</u>	RH %: <u>10.9</u>	RH %: <u>22.5</u>	RH %: <u>22.6</u>	RH %: <u>22.6</u>	RH %: <u>78.2</u>	RH %: <u>78.6</u>	RH %: <u>78.0</u>	RH %: <u>78.0</u>	Date Used	Audit
Time: <u>13:00</u>	T (°F): <u>78.2</u>	T (°F): <u>78.2</u>	T (°F): <u>78.2</u>	T (°F): <u>78.6</u>	T (°F): <u>78.6</u>	T (°F): <u>78.0</u>	T (°F): <u>78.0</u>			
ID #	Audit: <u>5000.0</u>	Audit: <u>5000.1</u>	Audit: <u>5000.0</u>	Audit: <u>5000.0</u>	Audit: <u>5000.1</u>	Audit: <u>5000.1</u>	Audit: <u>5000.1</u>			
S549	3334.2	3334.1								
S550	3330.9	3330.9								
S551	3426.7	3426.6								
S552	3370.6	3370.5								
S553	3359.5	3359.3								
S554	3350.1	3350.1								
S555	3417.6	3417.3	3417.4							
S556	3389.3	3389.5								
S557	3388.4	3388.5								
S558	4145.1	4145.3								
S559	3389.0	3389.1								
S560	4120.6	4120.6								
S561	3348.5	3348.8	3348.6							
S562	3372.7	3372.8								
S563	3373.5	3373.5								
S564	3424.2	3424.5	3424.5							
S565	3440.4	3440.6								
S566	3434.4	3434.6								
S567	3327.8	3328.2	3327.9							
S568	3372.8	3372.8	3372.8							
Initials:	TT	TT	TT	TT	TT	TT	TT			

Final Technician Signature: Tony Tong  
 Control No. P-SFDP-0002.xls, Effective Date: 2/3/2017

Initials: TT  
 Date: 07/20/23

Initials: TT  
 Date: 07/20/23

Evaluator signature: K. J. Morgan

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

Prepared By: \_\_\_\_\_ Balance ID #: \_\_\_\_\_ Thermohygrometer ID #: \_\_\_\_\_ Date Used: \_\_\_\_\_ Project Number: \_\_\_\_\_ Run No.: \_\_\_\_\_  
 Audit Weight ID #/Mass: \_\_\_\_\_

Placed In Dessicator:	Date: 7-5-23		Date: 7-6-23		Date: _____		Date: _____		Project Number	Run No.
	Time: 0945	Time: 0900	Time: _____	Time: _____	Time: _____	Time: _____	Time: _____	Time: _____		
Date: 6-27-23	RH %: 95	RH %: 12.2	RH %: _____	RH %: _____	RH %: _____	RH %: _____	RH %: _____	RH %: _____		
Time: 1300	T (°F): 72.9	T (°F): 75.9	T (°F): _____	T (°F): _____	T (°F): _____	T (°F): _____	T (°F): _____	T (°F): _____		
ID #	Audit: 5000.0	Audit: 4999.9	Audit: _____	Audit: _____	Audit: _____	Audit: _____	Audit: _____	Audit: _____		
5529	3424.2 ✓	3424.3 ✓							0582030038	2
5530	3301.8 ✓	3301.8 ✓							↓	↓
5531	3435.8 ✓	3435.2 ✓							↓	3
5532	3380.8 ✓	3381.0 ✓							↓	↓
5533	3362.7 ✓	3362.8 ✓							↓	↓
5534	3290.2 ✓	3290.2 ✓							7-13-2023	14
5535	3360.2 ✓	3350.3 ✓							↓	↓
5536	4147.3 ✓	4147.4 ✓							↓	↓
5537	3332.4 ✓	3332.8 ✓							7-17-23	5
5538	3277.3 ✓	3277.3 ✓							↓	↓
5539	3350.8 ✓	3360.8 ✓							↓	↓
5540	3314.2 ✓	3314.3 ✓							↓	↓
5541	3399.9 ✓	3399.9 ✓							↓	↓
5542	3312.4 ✓	3312.5 ✓							7-17-23	5
5543	3385.1 ✓	3385.2 ✓							↓	↓
5544	4093.3 ✓	4093.3 ✓							↓	↓
5545	4125.3 ✓	4125.5 ✓							↓	↓
5546	3422.6 ✓	3422.7 ✓							↓	↓
5547	3370.9 ✓	3370.9 ✓							↓	↓
5548	3371.2 ✓	3371.4 ✓							↓	↓

Final Technician Signature: \_\_\_\_\_ Date: \_\_\_\_\_ Evaluator signature: \_\_\_\_\_  
 Control No. P-SFDP-0002.xls, Effective date: 2/1/2017

Tare Sheet: (check one) Probes 47mm Filters 100mm Filters O-Ring Pair ✓  
 Prepared By: \_\_\_\_\_ Balance ID #: \_\_\_\_\_ Thermohygrometer ID #: \_\_\_\_\_ Audit Weight ID #/Mass: \_\_\_\_\_

Placed in Dessicator:	Date: <u>6-12-23</u>		Date: <u>6-13-23</u>		Date: _____		Date: _____		Date Used	Project Number	Run No.
	Date: <u>6-8-23</u>	Time: <u>0930</u>	Time: <u>1040</u>	Time: _____	Time: _____	Time: _____	Time: _____	Time: _____			
Time: <u>1700</u>	RH %: <u>17.5</u>	RH %: <u>12.6</u>	RH %: _____	RH %: _____	RH %: _____	RH %: _____	RH %: _____	RH %: _____			
Time: <u>1700</u>	T (°F): <u>75.0</u>	T (°F): <u>75.9</u>	T (°F): _____	T (°F): _____	T (°F): _____	T (°F): _____	T (°F): _____	T (°F): _____			
ID #	Audit: <u>5000.0</u>	Audit: <u>5000.0</u>	Audit: _____	Audit: _____	Audit: _____	Audit: _____	Audit: _____	Audit: _____			
5509	3364.7	3364.9 ✓									1
5510	3329.4	3329.6 ✓									2
5511	3344.1	3344.2 ✓									2
5512	3257.4	3257.5 ✓							6-21-23		2
5513	4147.1	4147.2 ✓									3
5514	3351.1	3351.2 ✓									3
5515	4164.8	4164.8 ✓									3
5516	3320.8	3321.0 ✓									4
5517	3320.7	3320.8 ✓									4
5518	3277.2	3277.4 ✓							6-22-23		4
5519	3337.7	3337.8 ✓									4
5520	3370.7	3370.9 ✓									4
5521	3422.7	3422.6 ✓							Not Used		4
5522	3397.3	3397.3 ✓									1
5523	3362.5	3362.4 ✓									1
5524	3335.2	3335.2 ✓									1
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5526	3320.2	3320.1 ✓							7-11-23	0552W5003E	1
5527	3269.0	3269.1 ✓									2
5528	3407.0	3407.0 ✓							7-12-23		2
	Initials: <u>RT</u>	Initials: <u>RT</u>	Initials: _____	Initials: _____	Initials: _____	Initials: _____	Initials: _____	Initials: _____			

Final Technician Signature: \_\_\_\_\_ Date: 7-31-23  
 Control No. P-SFDP-0002.xls, Effective date: 2/1/2017  
 Evaluator signature: K.P. Morgan



## **5. APPLIANCE ENGINEERING DRAWINGS**

**(CBI Report Only)**

## **6. APPLIANCE LABELING AND OWNER'S MANUAL**

**DO NOT REMOVE THIS LABEL** Contact local building or fire officials about installation and restrictions in your area. Suitable for use in a conventional residential installation. For use with solid wood fuel only.



**Nova C**  
**Model #003**

**Serial  
Number**

Solid Fuel Room Heater  
Report Number 0552WS003E

Tested to UL 1482 – 2011(R2015),  
ULC-S627-00 (R2016), and ULC  
S628-93 (R2016)

**Prevent House Fires:** Install and use only in accordance with the manufacturer's installation and operating instructions found in the Owner's Manual. Contact your local building or fire officials about restrictions and installation inspection in your area. Refer to local building codes and manufacturer's instructions for precautions required for passing a chimney through a combustible wall or ceiling. Do not run a chimney connector through a combustible wall or ceiling. Do not connect this unit to a chimney flue serving another appliance. Clearances may be reduced by methods specified in NFPA 211, listed wall shields, pipe shields, or other means approved by local building or fire officials. Do not overfire, if the chimney connector glows, you are overfiring. Inspect and clean chimney frequently – under certain conditions of use creosote buildup may occur rapidly. Do not use grate or elevate fire – build wood directly on hearth.

This wood heater contains a catalytic combustor, which needs periodic inspection and replacement for proper operation. Consult the Owner's Manual for further information. It is against the law to operate this wood heater in a manner inconsistent with operating instructions in the Owner's Manual, or if the catalytic element is deactivated or removed. CAUTION: the catalytic combustor used in this appliance (part #38) is fragile and must be handled carefully. Burn only dry wood. The burning of metal foils, plastic, garbage, sulphur and diesel oil will render the catalyst in the combustor inactive. The performance and durability of the catalytic combustor has not been evaluated as part of the certification.

Standard residential freestanding installations require a 6" diameter, minimum 24 MSG black chimney connector pipe with listed UL-103 HT factory-built chimney, suitable for use with solid fuels or masonry chimney. If installed on a combustible floor, a noncombustible floor protector must be used. Floor protection must be made of a non-combustible material and at least 0.018" (0.45 mm) thick. For a Nova C equipped with 6" legs and 6" ash lip, Nova C equipped with 9" legs, and for all Nova C Tower configurations, only Type 1 ember protection is required. For Nova C equipped with 3" legs, Type 2 thermal protection with minimum R-value of 1.35 is required. Do not obstruct the space beneath the heater. Operate with doors closed. The unit must be installed with provided legs or tower when installed as a free-standing stove. When installed as a fireplace insert this unit is for installation on non-combustible hearths only.

	Single Wall Connector Pipe	Double Wall Connector Pipe	Double Connector Pipe with Reduced Clearance Kit
A. Sidewall to unit	30" (508mm)	18" (458mm)	20" (508mm)
B. Backwall to unit	17" (432mm)	11" (280mm)	7.5" (191mm)
C. Sidewall to connector	28" (711mm)	26" (661mm)	26" (711mm)
D. Backwall to connector	22" (508mm)	14" (356mm)	13" (330mm)
E. Corner to unit	12" (305mm)	9.5" (241mm)	9.5" (241mm)
F. Corner to connector	21" (533mm)	18.5" (470mm)	18.5" (470mm)
G. Sidewall to unit	30" (508mm)	-	-
H. Backwall to unit	19.5" (493mm)	-	-
I. Sidewall to connector	28" (711mm)	-	-
J. Backwall to connector	13.5" (343mm)	-	-
K. Top of unit to 1/2" trim	8" (203mm)	-	-
L. Top of unit to 8" mantel	11" (279mm)	-	-
<b>Floor Protection</b>			
M. Front	18" US/18" CAN		
N. Side	8" (203mm)		
O. Chimney Connector	2" (51mm)		

Manufactured by:  
MF Fire, Inc.  
3031 Washington Blvd STE G,  
Baltimore, MD, USA  
www.mffire.com

35" (887 mm) Clearance  
Use UL 103 HT Chimney System  
Follow chimney manufacturer's instructions when passing through a combustible wall

Replace glass only with 5 mm ceramic glass



**CAUTION**

**HOT WHILE IN OPERATION. DO NOT TOUCH. KEEP CHILDREN, CLOTHING AND FURNITURE AWAY. CONTACT MAY CAUSE SKIN BURNS. SEE NAME-PLATE AND INSTRUCTIONS.**

**U.S. ENVIRONMENTAL PROTECTION AGENCY**

Certified to comply with 2020 particulate emission standards for single burn rate heaters. This single burn rate wood heater is not approved for use with a flue damper. Certified average emissions rate of 1.9 g/hr, tested to EPA Method 28R and ASTM E2515-11

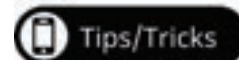
DATE OF MANUFACTURE: \_\_\_\_\_

# NOVA C AND NOVA C TOWER OWNER'S MANUAL



**Safety Notice: Please save these instructions for future reference. Please check our website for the most up to date version of this manual. 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. Contact local building or fire officials about restrictions and installation inspection requirements in your area. Do not install Nova C in a mobile home!**

Manufactured by: MF Fire, Inc. 3031 Washington Blvd STE G, Baltimore, MD, USA. Report Number 0522WS003E



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# Safety Precautions

## Installation

Nova C must be properly installed to prevent house fires. Please strictly adhere to the installation instructions.

Nova C must be connected to a listed high temperature chimney or approved masonry chimney with liner.

We recommend you use smoke and CO detectors.

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

Contact your local building officials to obtain information on any local wood stove installation requirements.

Carefully route all power cords through to avoid contact with hot stove surfaces.

Do not connect to or use Nova C in conjunction with any air distribution ductwork unless specifically approved for such installations.

## Operation

Nova C is hot while in operation. Keep children, clothing and furniture away as contact may cause skin burns.

Do not touch Nova C while hot. Young children should be supervised around Nova C.

Keep all flammable objects (fabrics, paper, wood, etc.) at least 1 yd (1 m) from the front of the Nova C.

Nova C has been designed for the burning of cordwood only. Do not attempt to burn any other type of fuel in Nova C.

Do not burn garbage or flammable fluids such as gasoline, naphtha or engine oil.

Do not use chemicals or fluids to start the fire.

Never use gasoline, gasoline-type lantern fuel, kerosene, charcoal lighter fluid, or similar liquids to start or "freshen up" a fire in this stove. Keep all such liquids well away from the stove while it is in use.

The viewing door of Nova C must be shut and latched during operation.

Do not use additional grates, andirons, or other means for supporting the fuel.

Never obstruct airflow through the inlet vents or exhaust vents.

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 instructions in this manual.

Never over-fire Nova C, as it could lead to a house fire. If the unit or chimney connector glows, you have over-fired the unit.

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.



## Maintenance

Allow Nova C to cool before conducting any maintenance.

Never attempt to modify or repair the appliance beyond instructions given in this manual.

Empty the ash regularly and dispose of it in a metal container with a tight lid.

Inspect the chimney connector at least twice monthly.

## Features and Specifications

### Configurations



*Nova C*

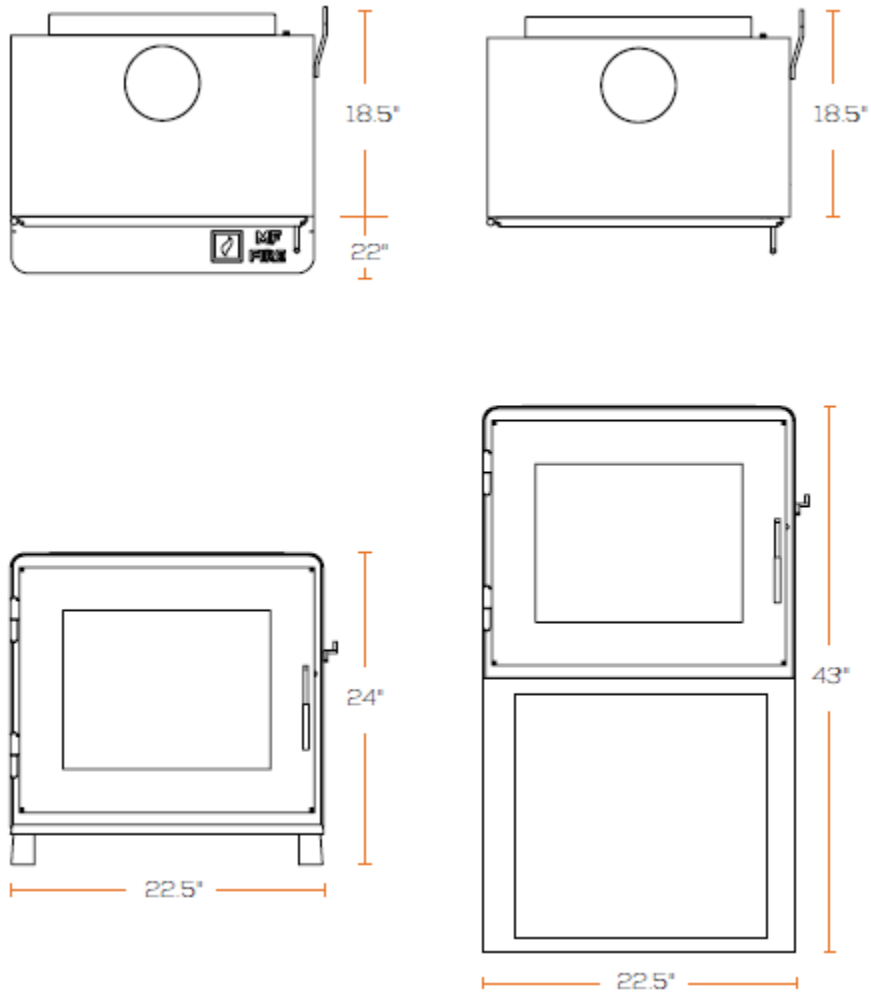
*Nova C Tower*

Nova C is available in two configurations, Nova C and Nova C Tower. Nova C can be optionally equipped with 3" (standard, shown above), 6", or 9" legs. Nova C Tower is available with no legs (standard, shown above) or 6" legs.

Additionally, both Nova C and Nova C Tower can be used in either a rear vent or a top vent configuration, to best fit your home and preferences.

## Dimensions

Dimensions shown are for the standard configurations. All clearances, front, side, corner, back and top, are measured from the largest dimensions.



## Heating Specifications

Nova C is equipped with a 1.7 ft.<sup>3</sup> firebox and accepts logs up to 18" in length.

Nova C has a 1,500 sq. ft. (175 m<sup>2</sup>) approximate maximum heating capacity. Heating capacity will vary depending on the home's floor plan, degree of insulation, and the outside temperature.

### **NOVA C TOWER**

Height with tower	43"
Width (w/o bypass)	22.5"
Width (w/ bypass)	23.6"
Depth	18.5"
Side to center of flue collar	11.25"
Height to center rear flue collar	38"
Back to center top flue collar	6.25"

Nova C has a 25,174 BTU per hour (7 kW) EPA certified heat release rate, with actual heat release rates ranging from 9,000 to 50,000 BTU per hour (2.5 to 15 kW) depending on user loading and reloading.

## Emissions and Efficiency

U.S. Environmental Protection Agency certified to comply with 2020 particulate emission standards for single burn rate heaters. This single burn rate wood heater is not approved for use with a flue damper. This heater meets the 2020 U.S. EPA's crib wood emission limits for wood heaters. Tested to EPA ASTM E2780-10, ASTM 2515-11, and CSA B415.1-10. This heater has been shown to deliver an average Emissions rate of 1.9grams/hour and 71% HHV Efficiency

## Safety Listings

Nova C is available for sale in the United States and Canada has been listed with OMNI-Test Laboratories and is tested and compliant in accordance with UL 1482 – 2011(R2015), ULC-S627-00 (R2016), and ULC S628-93 (R2016)

## Label

Nova C comes with a metal certification label on a chain affixed to the bottom back of the stove. This label is in English and French. For safekeeping, the label may be affixed to the air duct of the stove during installation.

# Stove Installation

**Safety Notice: 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. Contact local building or fire officials about restrictions and installation inspection requirements in your area. Do not install Nova C in a mobile home!**

## Planning the Installation

Proper care and attention to service helps to protect you from unnecessary fires and carbon monoxide poisonings. To get the best service and wood stove installation for your Nova C wood stove, we recommend Installers or Chimney Sweeps certified by the National Fireplace Institute (NFI) or the Chimney Safety Institute of America (CSIA).

To locate one of the more than 2,000 active NFI or CSIA Certified installers across North America, please use the installer locator on our website: <https://mffire.com/installers/>

Check with your local building officials and your home insurance company before installation. When this room heater is improperly installed, a house fire may result. To reduce the risk of fire, follow the installation instructions. Contact local building or fire officials about restrictions and installation inspection requirements in your area. If there are any major dents or other damage to your stove, please report to MF Fire prior to installation.

## Stove Placement Requirements

Nova C must be placed in a room with a source of fresh air. The minimum room height that the stove can be installed in is 8 feet.

Nova C must be placed so that no combustibles are within or can swing within 36" (914mm) of the front of the stove (drapes, doors, etc.).

**Caution: Avoid makeshift compromises during stove placement or installation. Failure to follow instructions may result in property damage, bodily injury, or even death.**

## Minimum Clearance and Floor Protection Requirements

Nova C may be installed as a top vent with a ceiling exit in either a standard or corner configuration, or as a rear vent with a direct rear exit. The minimum clearance requirements are listed in the table below. Clearances may be reduced following methods in NFPA 211, listed wall shields, pipe shields, or other means approved by local building or fire officials.

Nova C must be installed on a non-combustible surface or with adequate floor protection. Floor protection must extend around the front, sides, and rear of the stove, according to listed clearance requirements below.

Floor protection must be listed to UL 1618. Floor protection must be made of a non-combustible material and at least 0.018" (0.45 mm) thick. For a Nova C equipped with 6" legs and ash lip, Nova C equipped with 9" legs, and for all Nova C Tower configurations, only Type 1 ember protection is required. For Nova C equipped with 3" legs, Type 2 thermal protection with minimum R-value of 1.35 is required.

## Chimney Connector Requirements

A chimney connector is required from the flue collar of the stove to the factory-built chimney or a masonry chimney. The chimney connector must be 6" (152 mm) diameter and at minimum 24 gauge black steel. Aluminum or galvanized steel is not allowed – these materials cannot withstand the flue temperatures and may give off toxic fumes when heated.

The chimney connector may not pass through a ceiling, attic, roof, closet, or similar other concealed space, or a floor or ceiling. Per, ULC, where passage through a wall, or partition of combustible construction is desired, the installation shall conform to CAN/CSA-B365, Installation Code for Solid-Fuel- Burning Appliances and Equipment

Use listed UL 103 HT chimney – see “Chimney Requirements for details. **DO NOT USE CONNECTOR PIPE AS CHIMNEY.**

The chimney connector should be as short and direct as possible. No more than 180° of elbows (two 90° elbows or two 45° and one 90° elbow, etc.) may be used for the entire chimney system. Horizontal runs should slope upwards at least 1/4" (6 mm) per foot and be a maximum 36" (914 mm) long.

NOTE: Additional elbows may be allowed if draft is sufficient. Whenever elbows are used the draft is adversely affected. Additional chimney height may be required to boost draft.

The chimney connector must be installed with the crimped end pointing downwards. This prevents creosote or condensation from leaking to the exterior of the pipe.

The chimney connector must be fastened to the stove and each adjoining section and kept clean.



## Chimney Requirements

**The minimum chimney height, as measured from the stove top, is 15 feet.** Do not connect Nova C to a chimney flue serving any other appliance or use in conjunction with any air distribution ductwork, unless specifically approved.

This room heater must be connected to:

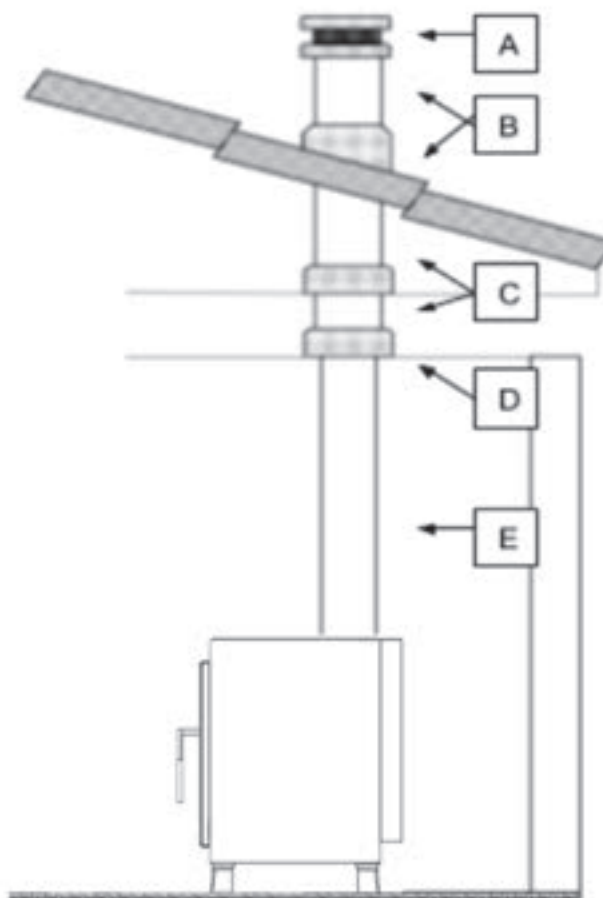
1. A 6" (150 mm) diameter, UL 103 HT chimney, from a single manufacturer

OR

2. A code approved masonry chimney with a flue liner.

### Standard Chimney Arrangement

- A. Chimney termination
  - a. Minimum height: 15' (4.5m)
  - b. Maximum height: 33' (10 m)
- B. Roof penetration
- C. Chimney sections
- D. Ceiling penetration
- E. Chimney connector

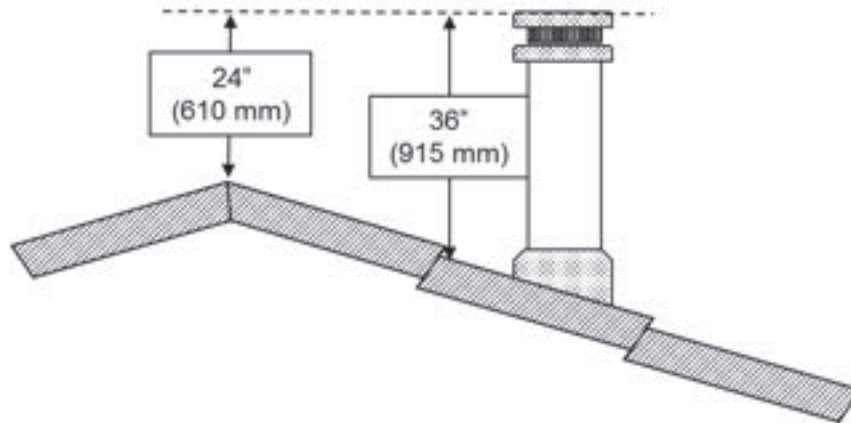


## Chimney Termination Requirements

The chimney must have an approved cap (to prevent water from entering).

The chimney must not be located where it could become plugged by snow or other material.

The chimney must terminate at least 3' (914 mm) above the roof and at least 2' (610 mm) above any portion of the roof within 10' (3 m).

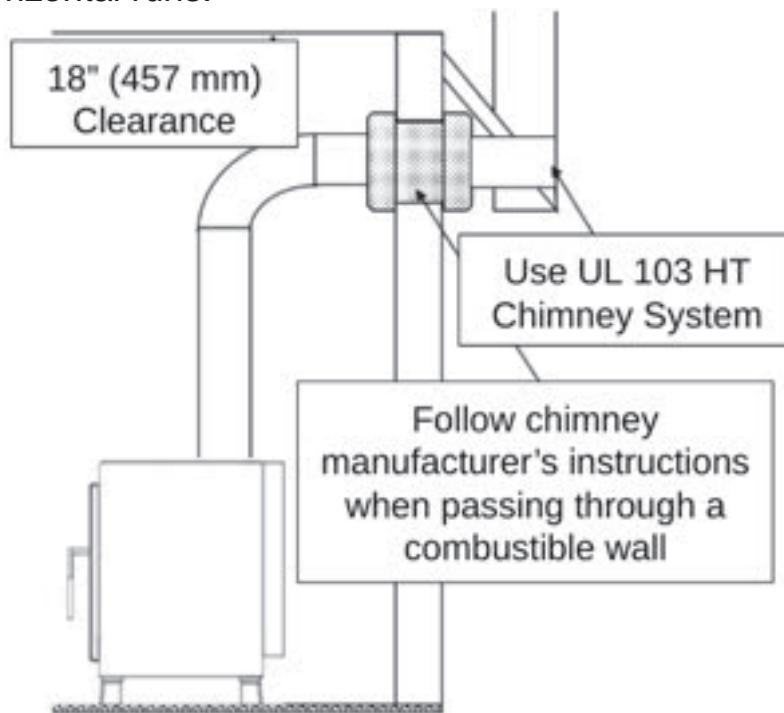


## Exterior Factory-Built Chimney: Special Installation

Nova C may be used in conjunction with an exterior factory-built chimney provided that the chimney meets UL 103 HT requirements.

Special care must be taken regarding the wall thimble, or penetration from the chimney connector pipe to the exterior chimney, if the wall thimble must pass through an exterior wall. Here all chimney manufacturer's instructions must be followed, including guidance on spacing to combustible surfaces, piping requirements, and liner requirements. Check with local authorities before installation to ensure all requirements are met.

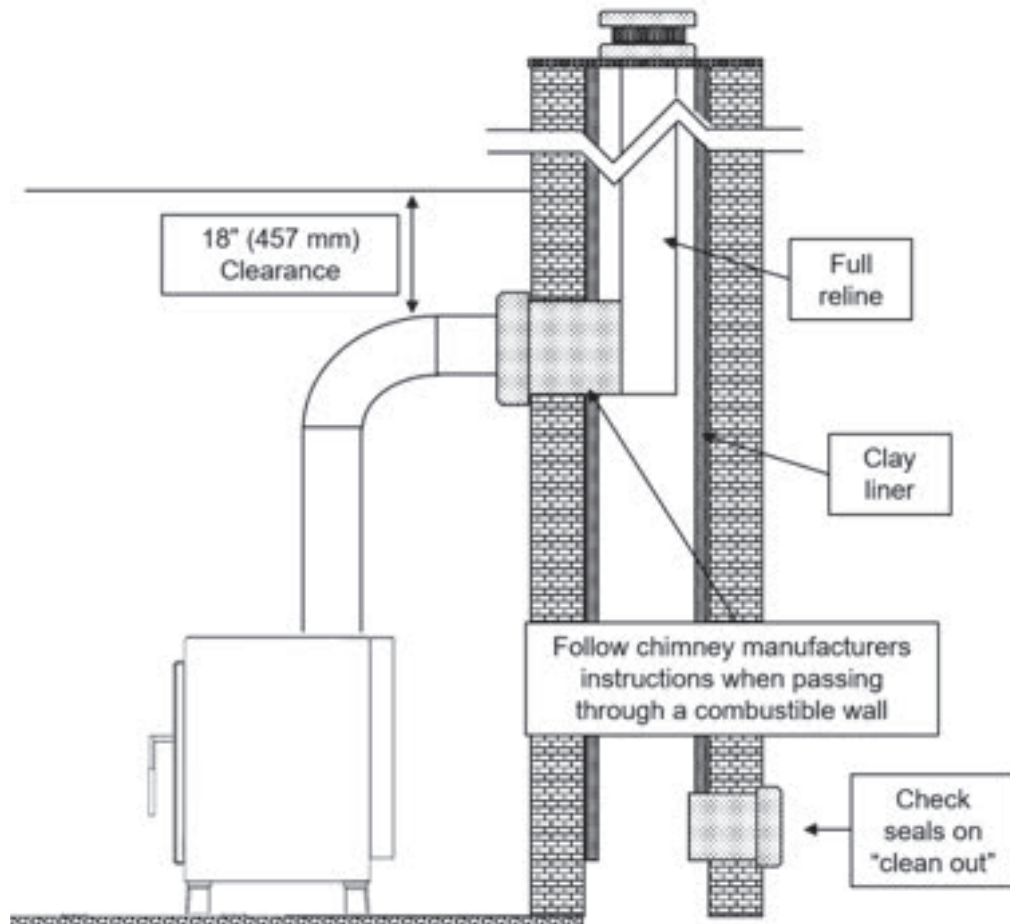
Floor protection is required 2" on both sides of the chimney connector for any horizontal runs.



## Masonry Chimney: Special Installation

Nova C may be used in conjunction with a masonry chimney provided all installation instructions are followed.

We strongly recommend a full reline when installing the Nova C in a masonry chimney. If the chimney does not have a clay tile liner, a full reline is required. The chimney must be clean, undamaged, and meet all local building codes.

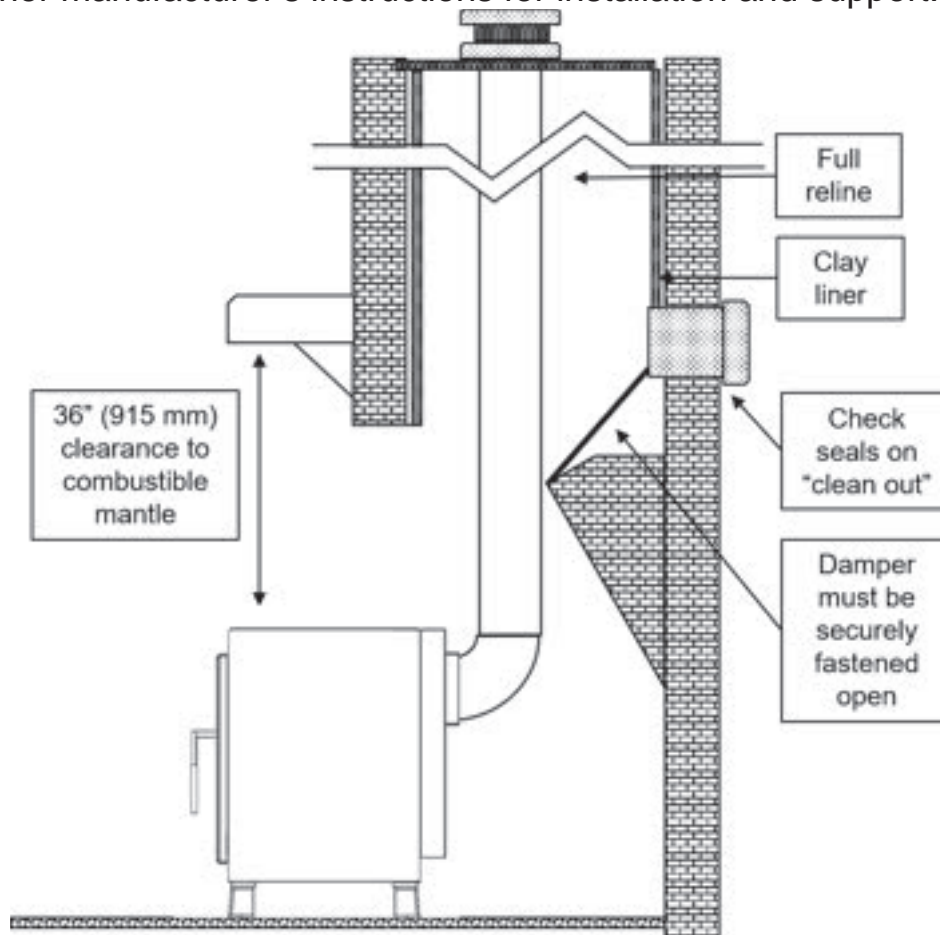


Special care must be taken regarding the wall thimble, or penetration from the chimney connector pipe to the masonry chimney, if the wall thimble must pass through a combustible exterior wall. Here all chimney manufacturer's instructions must be followed, including guidance on spacing to combustible surfaces, piping requirements, and liner requirements. Check with local authorities before installation to ensure all requirements are met.

## Hearth Mount in Masonry Fireplace: Special Installation

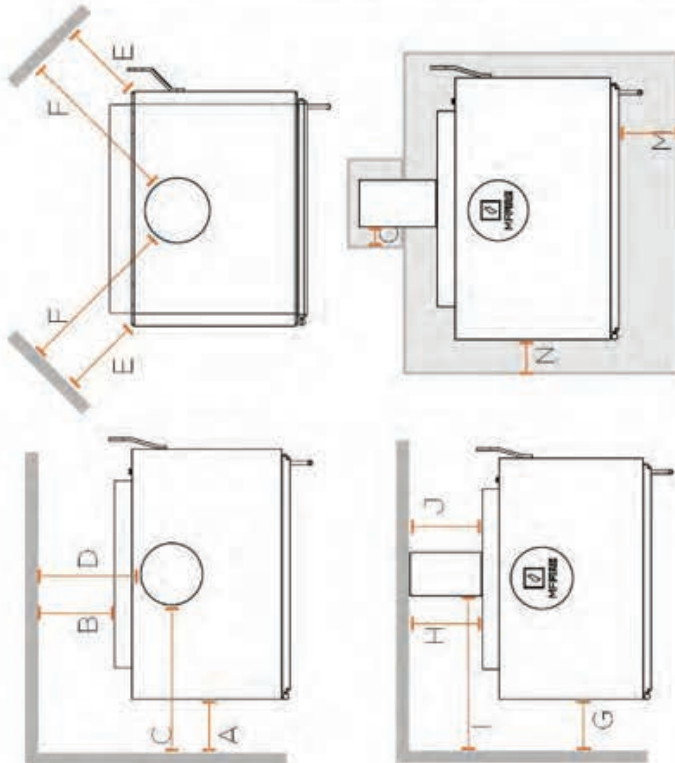
Nova C may be used in conjunction with a masonry fireplace provided all installation instructions are followed.

The entire fireplace must be clean, undamaged, and meet all local building codes. This installation requires a full reline. The liner must be a stainless steel chimney connector or flexible vent pipe. Follow the liner manufacturer's instructions for installation and support.



## MINIMUM CLEARANCE REQUIREMENTS

		Single Wall Connector Pipe	Double Wall Connector Pipe	Double Wall Connector Pipe with Reduced Clearance Kit
A	Sidewall to unit	20" (508 mm)	18" (458 mm)	20" (508 mm)
B	Backwall to unit	17" (432 mm)	11" (280 mm)	7.5" (190 mm)
C	Sidewall to connector	28" (711 mm)	26" (661 mm)	28" (711 mm)
D	Backwall to connector	20" (508 mm)	14" (356 mm)	11" (280 mm)
E	Corner to unit	12" (305 mm)	9.5" (241 mm)	9.5" (241 mm)
F	Corner to connector	21" (534 mm)	18.5" (470 mm)	18.5" (470 mm)
G	Sidewall to unit	20" (508 mm)		
H	Backwall to unit	13.5" (343 mm)		
I	Sidewall to connector	28" (711 mm)		
J	Backwall to connector	13.5" (343 mm)		
K	Top of unit to ¼" trim	8" (203 mm)		
L	Top of unit to 8" mantel	11" (280 mm)		
	<b>Floor Protection</b>			
M	Front	16" US/18" CAN		
N	Side	8" (203 mm)		



## FLOOR PROTECTION REQUIREMENTS

Leg Height	With Ash Lip	Without Ash Lip
3"	R = 1.35	R = 1.35
6"	Type I	R = 1.35
9"	Type I	Type I
<b>Tower</b>	Type I	Type I
<b>Bench</b>	Type I	Type I

## Installing Legs and Ash Lip (Optional)

Nova C will arrive bolted to a pallet with legs and leg bolts packed separately. The leg securement bolts are located inside the firebox and labeled “Leg Pad Bolts”. If ordered with the optional ash lip, the ash lip will contain two spacer plates for the rear legs, four longer bolts, and two filler pieces for the ash lip when used in the 6” position. To install the legs follow the steps below. If you ordered a Nova C Tower, you can skip these steps.

**Step 1:** Unbolt Nova C from the pallet and gently rock back onto a soft surface such as a rug or a blanket. If installing the ash lip follow step 2, if not go directly to step 3.

**Step 2:** Press the ash lip up against the bottom of the stove such that two appropriate holes (front for 4” ash lip, rear for 6” ash lip) are over the leg pad holes. Note: In Step 3, installation will require the included longer leg bolts for installing the ash lip.

Place spacer plates between over the leg pads on the rear legs of the stove.

**Step 3:** Position a front stove leg so that the hole in the leg aligns with the hole in the leg pad. Insert the bolt and washer through the leg, into the leg pad hole. Rotate the leg so the solid sides are parallel to the outside edges of the stove. Use a wrench tighten the bolt. Repeat for all four legs.





## Configuring the Optional Rear Vent

Nova C can be configured as either a top venting or a rear venting stove. Nova C will arrive in the top vent configuration. To switch to the rear vent configuration, the following procedure may be followed.

**Step 1:** Remove the rear blocker plate collar, secured with 4 bolts and 1 washer each, and access panel, secured with 6 bolts and no washers, from the back of the stove as shown below.



**Step 2:** Next, reach inside the back of the stove and remove the spacer plate and the flue collar, secured with 4 bolts and 2 washers each, located on the inside top of the stove.



**Step 3:** The blocker plate that was removed from the rear of the stove can then be inserted over the opening at the top of the stove, the spacer plate placed below, and the entire assembly secured to the top of the stove with bolts as shown below. Before tightening bolts, be sure that no gaps exist between the blocker plate and the top of the stove whereby smoke may escape. If necessary, gasket cement can be placed between the plate and the top of the stove.



**Step 4:** Replace the access plate and install the flue collar, as shown below.



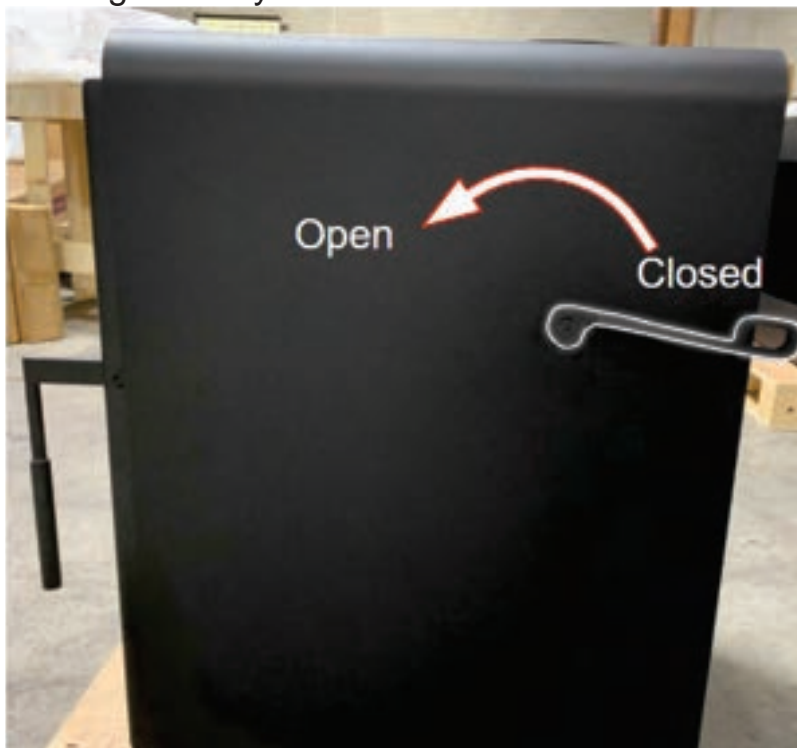
## Installing the Bypass Handle

Nova C comes with the bypass handle detached for safety during transport.

**Step 1:** Remove the set screw from the bypass handle.



**Step 2:** To install the bypass handle simply slide the handle over the bypass rod on the back of the right side of the stove such that the handle is pointed towards the rear of the stove, with the bent portion of the handle angled away from the stove as shown below.



**Step 3:** Rotate the bypass handle on the bypass rod until the set screw holes are aligned with the holes in the bypass handle, insert the set screw in the rear-most hole, and tighten into the hole. Tighten the set screw, wiggle the handle, tighten the set screw, wiggle the handle, etc. until the handle is tight and there is no wiggle.

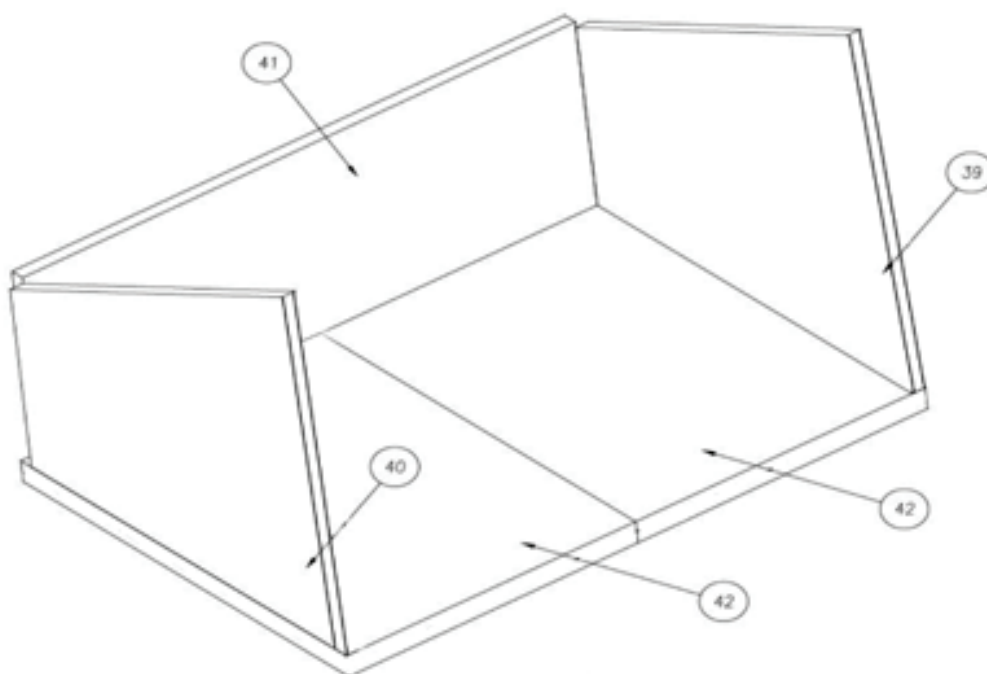
## Insulation and Fire Brick

Nova C comes equipped with a two-part insulation strategy to maintain clean, efficient fires and a long lasting coal bed. The insulation blanket maintains efficient and long-lasting heat while the fire bricks provide a durable platform for your fire and maintain smooth even heating.

The insulation is pre-installed in the firebox, while the fire bricks must be installed before the first fire and should be installed following the procedure below. Gloves and safety glasses should be worn during installation.

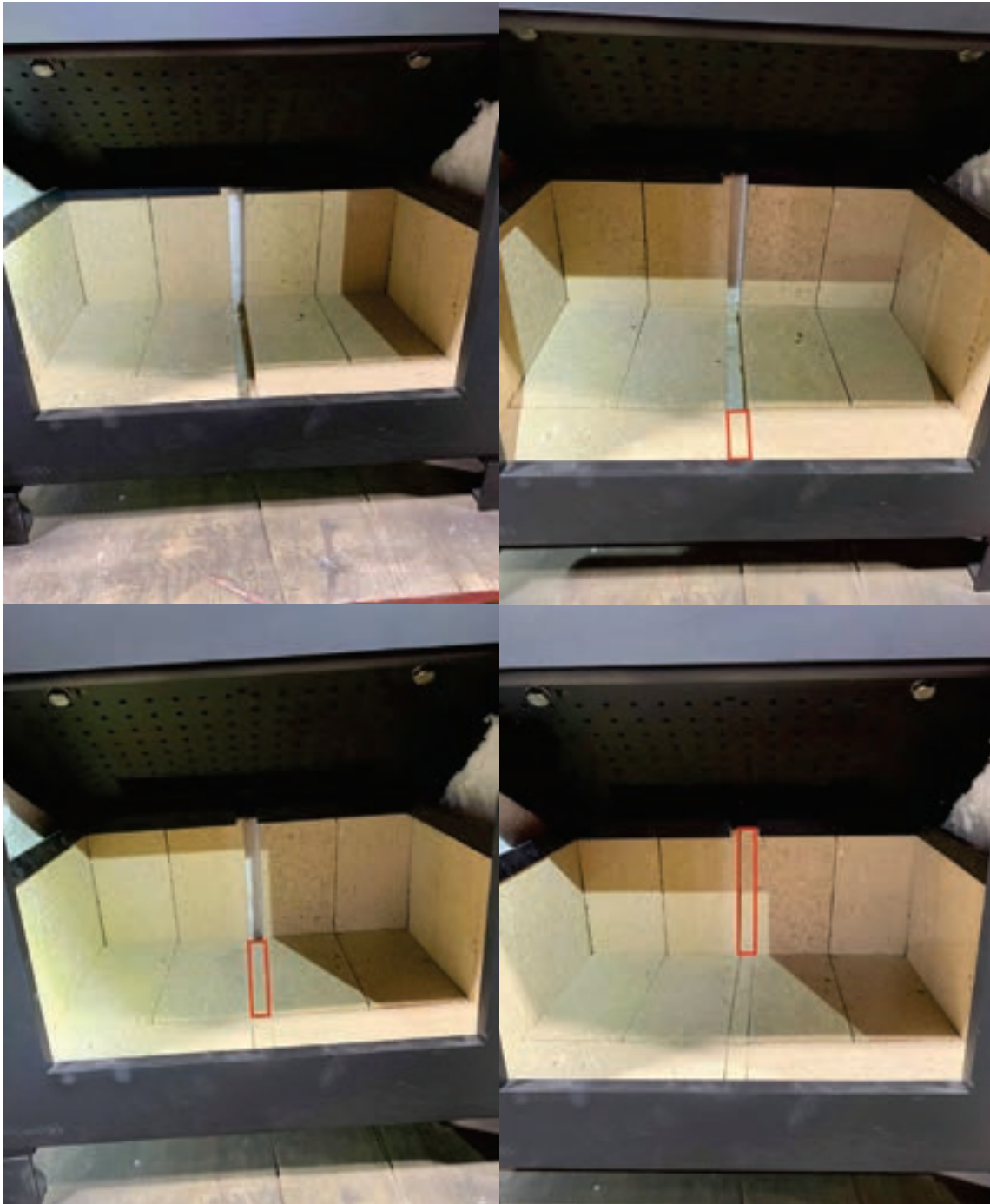
**Step 1:** Unpack the fire bricks that accompany your Nova C, and ensure all pieces are present. The fire bricks received with your stove may not have the corresponding numbers in the steps below.

**Step 2:** The insulation blanket will be pre-installed as shown below.

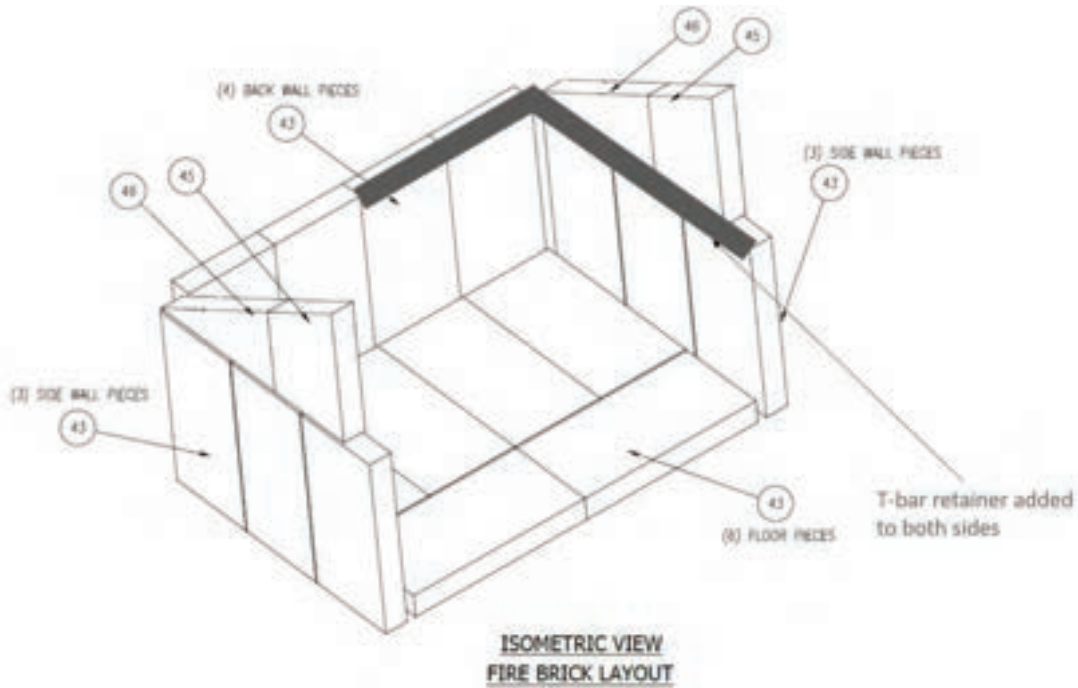


**Step 3:** Next, install the fire bricks. The first fire bricks to install are the four rear wall bricks and then the three bricks on the left and right sidewall. A small gap may exist in between the corner of the fire bricks as shown in the line drawing below. Next, install the six fire bricks on the floor of Nova C. Push all fire bricks up against the side and back walls. You may have a gap in the middle of the firebox as

shown below. These can be filled with the brick slivers contained within your fire brick boxes.



Lastly, the partial bricks that make up the second row of bricks on the side of the stove should be installed. To hold this row of bricks in place, the two T-bar retainers need to be inserted on top of the vertical row of fire bricks on both sides of the stove.



Occasionally due to small variations in components and materials, it is normal for the bricks and fiberboard to have differing degrees of fit in any stove, but the specific fit and tolerance will not change or impact your stove performance. This includes slight gaps or a tight fit. In the event some bricks are tight, some adjustment or manual force may be needed to install these pieces. Slight gaps will be filled with ash from your first few fires.

## Catalytic Combustor

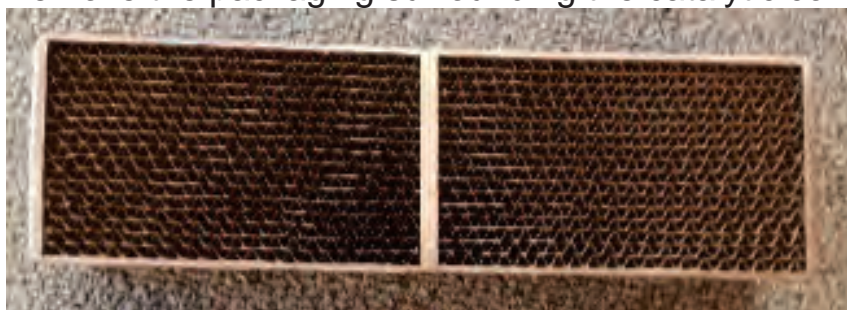
The Nova C catalytic combustor (Part # N11) is a long rectangular piece with a honeycomb-like structure.

It can easily be installed as a final step prior to using your stove. Nova C may not be operated without the catalytic combustor properly installed. To prevent improper operation, Nova C has a special catalytic combustor swing door that stops airflow if the catalytic combustor is improperly installed.

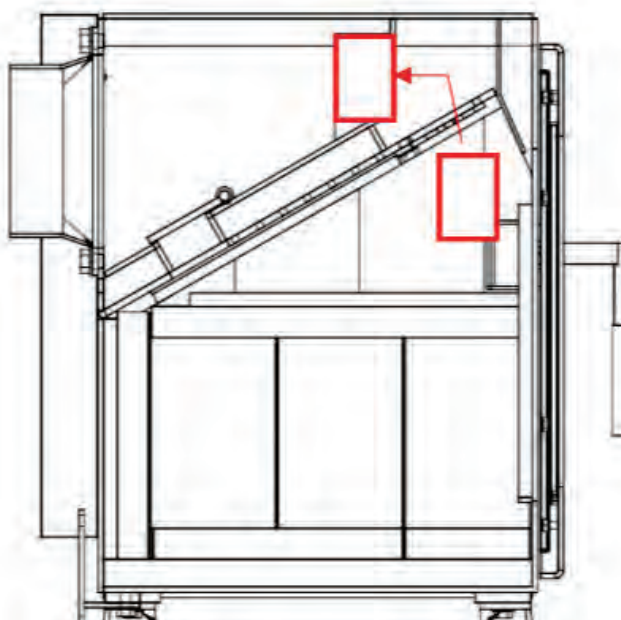
To install the catalytic combustor and flame shield follow the steps below and watch the video using this QR code:



**Step 1:** Remove the packaging surrounding the catalytic combustor.



**Step 2:** Slide the catalytic combustor through the rectangular opening. The mesh sides should be facing the front and rear of the stove as shown in the diagram below.





**Step 3:** Slide the catalytic combustor into the holding box, pushing back the combustor door, and sliding the combustor back as far as it can go in the holding box. The combustor may be a snug fit, which is normal.

**Step 4:** Insert the 'U' shaped retaining peg in the front of the catalytic combustor. The combustor retaining peg may be in the top of the stove in front of the combustor.

**Caution:** Without this retaining peg the catalytic combustor may fall forward, preventing the stove from operating as intended.

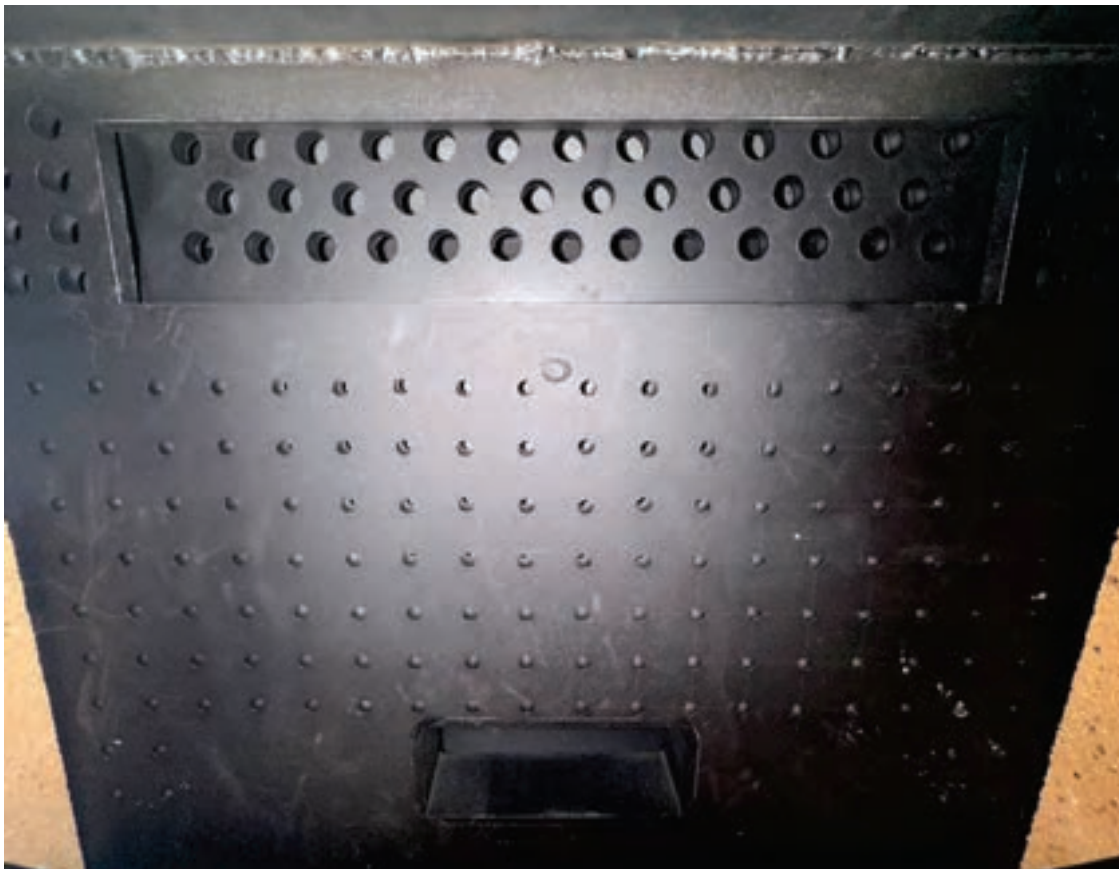
**Step 6:** Install the flame shield.

To install the flame shield (shown below), take the flame shield and angle it up into baffle opening where the combustor passed through. Next, lay the flame shield flat with the two tabs pointed towards the rear of the stove.





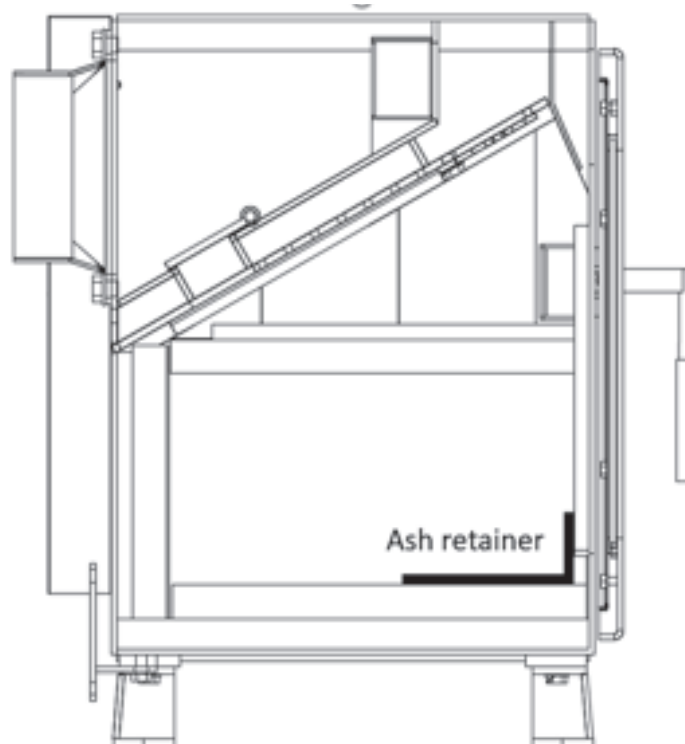
*Flame shield*



*Flame shield final position*

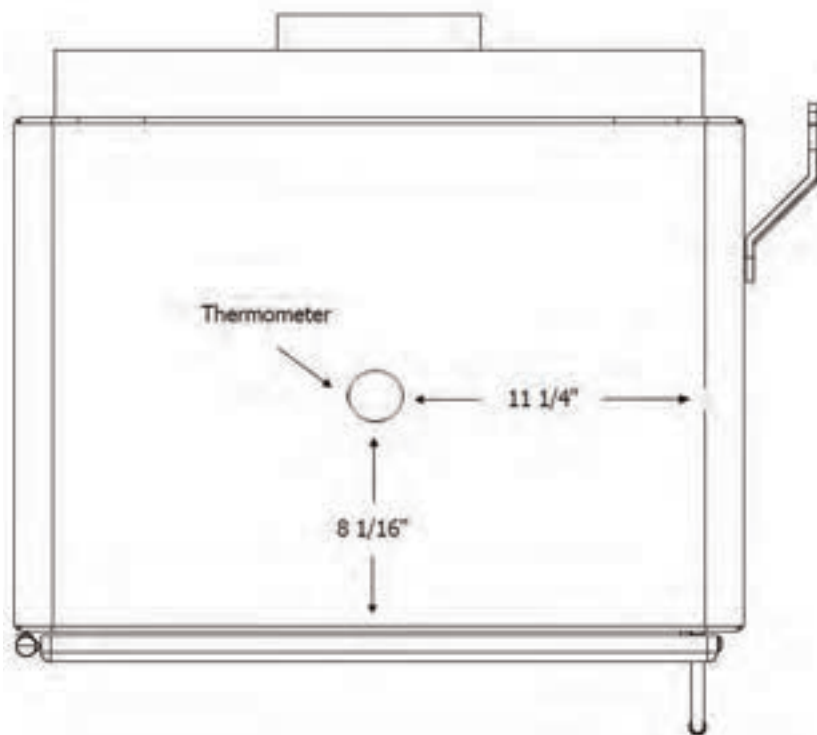
## Ash Retainer

Your Nova C comes standard with a removable ash retainer to extend the number of burns between emptying the ash. The 6" leg L-shaped ash retainer is placed directly on the brick on the firebox floor, and flush with the front inside of the stove, as shown below.



## Stove Top Thermometer

The stove top thermometer is an accessory that can be used to help determine when to close the catalytic combustor bypass on your Nova C. The thermometer should be placed on the stove top, 8" from the front of the stove and 11.25" from the side of the stove. For most uses, when the thermometer reads "ENGAGE CATALYST", the catalytic combustor bypass can be swung closed (to the rear of the stove).



## Initial Curing

During the first burn of your wood stove, the paint on the stove may off-gas as part of its final curing process. This is to be expected. Open windows and ventilation means are recommended. Please refer to the Exterior Paint section for additional details.

## Operation

Nova C is built to be simple and easy to use. It just works. We designed Nova C with no dampers to play with. Just build a fire, sit back and enjoy. Below are written operation instructions. We also highly recommend watching our series of videos on how to best operate your stove using this QR code:



### Bypass

Nova C is equipped with a bypass lever for the catalytic combustor. The bypass handle is located on the right side of the stove and should be operated with the included fall-away handle. When not used, the fall-away handle can be stored on the rear of the unit.

The bypass should always be used in conjunction with the front-loading door. Prior to opening the stove door, the bypass should be rotated forward to the open position. The door may then be opened. To minimize smoke spillage when reloading, open the door slowly, cracking it for several seconds before fully opening. After reloading your stove the door may be closed and then the bypass rotated to the closed position. By operating the two in conjunction with one another you may minimize smoke spillage and maximize the efficiency of your stove.

### Starting a Fire

We strongly recommend a top-down fire for burning in Nova C. In the top-down fire method, larger pieces of wood are first placed on the floor of the wood stove fire box, with smaller pieces of wood, kindling, and newspaper on top. Take a match or lighter to the newspaper, and the fire will burn slowly into the kindling and to the larger logs underneath. It may take a few tries to build a fire with the top-down fire in order to get it just right, but the result is a cleaner, easier, and by far the best way to build a fire in a wood stove.

#### **Step 1: Establish draft**

If starting from a cold start it is important to establish draft in your chimney before filling the stove with wood. Chimney's draft when they are hotter than the air outside the chimney. Particularly on warm mornings in the spring or the fall, the chimney can be colder than the outside air. In this situation, air will flow down your chimney, through your stove, and into the room.

To remedy this, simply open the bypass and ignite a few pieces of newspaper up near the bypass opening until the flames are noticeably drawn (or sucked in) towards the bypass opening in the rear of the stove.

### **Step 2: Build the base**

Set larger logs on the floor of your wood stove firebox.

In beginning to build a fire, it is necessary to begin with a solid foundation of wood. The pieces should be at least 3 – 5 inches in diameter.

### **Step 3: Build the fire ladder**

Set a 2nd layer of medium logs atop the larger logs in a crisscross fashion. It is best to choose medium logs which are approximately 50%-75% of the size of the larger logs. Then, place a third layer of small logs atop the medium logs in a crisscross fashion. The small wood pieces should be approximately 1-2 inches in diameter.

The fire initial fire you build will catch the smallest logs and these in turn will catch the medium logs which will in turn catch the largest logs.

### **Step 4: Place the kindling**

Set fine kindling on top of small logs. Typically, we place wood splits, heavy duty cardboard, or both.

### **Step 5: Prepare the ignition material**

We like using knots of newspaper as our ignition material. To make a newspaper knot, tear a sheet of newspaper, twist it together to create a rope-like piece, and tie into a knot. Place three or four knots above the kindling evenly throughout the width of the fire box.

### **Step 6. Light the fire**

Be sure the bypass is still open (see Bypass section) and then ignite the newspaper. Leave the door open just a crack, being sure to monitor the fire at all times when the door is open. Ignite the newspaper knots. This can be done quickly with a long match or stick lighter.

## Controlling the Burn

Your Nova C has only one burn mode – perfect. If you would like more or less heat out of your Nova C, simply load more or less wood into your stove.

## Reloading

The best time to reload your wood stove is when there are hot coals remaining and there is none or limited active flaming. When reloading, if there is a large coal bed (glowing red coals, covering the entire bottom, at least an inch deep), there is no need to use kindling or newspaper. To reload, open the bypass and then slowly open the front door. Fill the firebox chamber with logs, taking care not to stack the logs too close or touching the front door glass. Then simply shut the door and walk away. Close the bypass when the provided thermometer reads “ENGAGE CATALYST”.

## Wood Selection

Use ONLY untreated wood in your Nova C. The use of any other fuel may result in unsafe burning conditions that could cause damage to. When choosing wood, you should use non-resinous, seasoned hardwoods if possible. Examples of appropriate hardwoods are oak, ash, and maple. Seasoned wood is wood with between 15-20% moisture content. To test the moisture content, split a piece of wood and use your wood moisture meter on the interior center of the wood. Store this wood in a dry place and remote from your Nova C.

Why does dry wood matter? It burns much more efficiently, increasing heat output from the stove and reducing creosote buildup in the chimney. Refer to our website blog posts for additional information regarding non-resinous, seasoned hardwoods.

## Ordinary Operating Sounds

During the typical operation of your Nova C, the wood stove will make occasional creaking noises. This is completely normal and is likely caused by the heating and cooling of the stove.

## Regular Maintenance and Troubleshooting

Wood stoves, even those as clean as Nova C, must be cleaned frequently because soot, ash, and creosote may accumulate.

Establish a routine for the fuel, wood burner and firing technique. Check daily for creosote build-up until experience shows how often you need to clean to be safe. Be aware that the hotter the fire the less creosote is deposited, and weekly cleaning may be necessary in mild weather even though monthly cleaning may be enough in the coldest months. Contact your local municipal or provincial fire authority for information on how to handle a chimney fire. Have a clearly understood plan to handle a chimney fire.

### Glass

**Caution: Do not clean the glass while hot. Glass could shatter causing burns and permanent damage.**

The glass will accumulate some soot through the course of regular burning. More soot will accumulate during slow burns than during hotter burns. Sooting is worse with unseasoned or resinous woods. To clean the glass, the unit should be allowed to cool. Use a soft cloth and a non-ammonia, non-abrasive cleaner. There are many options for wood stove glass cleaner, including on the MF Fire website.

Sooting may also be a result of a loose door or glass seal. If there is smoke leakage around the edges of the glass, the glass seal may be improved by tightening the various bolts and nuts securing the glass to the door. Tighten with hand tools only. Machine tightening may result in glass breakage. Do not over tighten.

### Disposal of Ashes

Ashes should be placed in a steel container with a tight-fitting lid. The closed container of ashes should be placed on a noncombustible floor or on the ground, well away from all combustible materials, pending final disposal. If the ashes are disposed of by burial in soil or otherwise locally dispersed, they should be retained in the closed container until all cinders have thoroughly cooled.

## Door Gaskets

Inspect all gaskets and door seals before each use. Nova C should be operated with the front door tightly shut.

## Catalytic Combustor

This wood heater contains a catalytic combustor to help achieve a clean burn. It is important to periodically monitor the operation of the catalytic combustor to ensure it is properly functioning, and not clogged. A clogged or otherwise non-functioning combustor will result in poor performance, smoke leakage, a loss of heating efficiency, and an increase in creosote and emissions.

Your catalytic combustor should be visually inspected at least monthly to check its condition. Do not attempt to inspect the catalytic combustor unless the stove is cool and not currently in use. To inspect the catalytic combustor simply open the door of your wood heater and remove the bolts holding the flame shield in place. If there is some ash on the catalytic combustor, use a soft bristled brush or vacuum to clean off the ash.

A properly functioning catalytic combustor maintains temperatures in excess of 600 °F. Following cleaning, if the catalytic combustor does not function, it may need to be replaced. For replacement instructions refer to the Catalytic Combustor Troubleshooting and Replacement section of this owner's manual.



## Monthly Maintenance

### Creosote – Formation and Need for Removal

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

The chimney and chimney connector should be inspected at least once every two months during the heating season to determine if a creosote buildup has occurred. If creosote has accumulated, it should be removed to reduce the risk of a chimney fire.

The use of unseasoned (wet, green) and/or resinous wood will increase the formation of creosote.

If you are not confident in performing a creosote inspection, contact a local chimney sweep to perform an inspection. Excess creosote buildup may cause a chimney fire that may result in property damage, injury, or death.

### Gasket

There is a gasketing located on the front door, and on the front door glass. The gasket in these areas should be visually inspected for any signs of deterioration or smoke leakage into the room. If the gasket is deteriorating, contact MF Fire for a replacement gasket.

# Annual Maintenance

## Exterior Paint

To fix areas on the exterior of the stove that have been scratched or scraped, simply use aerosol stove paint. The paint needed for color match touch-up is Stove Bright Satin Black (1990).

Paint should only ever be applied while the stove is cool. Allow the paint at least one hour to cool. After applying the paint, the newly painted area may appear darker than original until it is cured. When using the stove next, the curing process may give off some fumes.

## Glass

In the event of broken door glass, a new pane of glass must be installed before usage may continue. **Do not operate with broken glass!**

To prevent broken glass, avoid striking the glass, slamming the door shut, or building the fire too close to the glass.

To replace broken glass, carefully open the front door while the stove is cool. Remove large shards with gloves and dispose of appropriately. Then carefully unscrew the interior door frame, taking care to keep all screws.

Replace the glass with official MF Fire replacement glass. Do not use unauthorized substitute materials. Contact your place of purchase if replacement glass is needed.

When replacing glass, ensure the glass is properly surrounded by graphene impregnated wood stove gasket, and centered over the window opening.

## Catalytic Combustor Replacement

If you suspect that your catalytic combustor is not working, the catalytic combustor should be removed and inspected to identify the source of the problem.

**CAUTION: DO NOT OPERATE THE NOVA C WOOD HEATER WITH CATALYTIC COMBUSTOR REMOVED!**

To access the catalytic combustor follow the instructions in the catalytic combustor installation section of this manual.

If any cracking or peeling is observed, the catalytic combustor must be immediately replaced. Please contact your place of purchase for a replacement catalytic combustor.

**Safety Notice: Burn untreated wood only. Burning materials such as treated wood, metal foil, coal, plastic, garbage, sulphur, or oil may damage the catalytic combustor. Excessive smoking indicates the combustor has failed and requires replacement.**

## Appendix A: Nova C Tower Assembly

Nova C Tower ships with the Nova C stove, a Nova C Tower Pedestal, and optionally 6" pedestal legs.

To assemble the Nova C Tower, follow all instructions and guidelines above and the additional guidance below. Please note, Nova C must be attached to the Nova C Tower Pedestal before the installation of ceramic fiberboard and firebricks.

### Attaching the Nova C Tower Pedestal

**CAUTION: Nova C and Nova C Tower are heavy. To avoid injury, at least two people should be used to perform all assembly steps involving heavy lifting.**

**Step 1:** If installing the optional Nova C Tower 6" legs, carefully rotate the Nova C Tower Pedestal on to its side on a soft surface, such as a blanket or carpet as shown below.

Skip to Step 3 if you did not order optional 6" pedestal legs.



**Step 2:** Using the bolts and washers provided, tightly fasten the 6” legs to the bottom of the pedestal using a socket or adjustable wrench. The hollow side of the legs should point towards the center of the stove, with the flush square surface attached to the stove, as in the image below.



**Step 3:** Carefully rotate Nova C Tower Pedestal into the upright position and place in its final position. Follow all requirements in the Stove Placement Requirements section. Your Nova C Tower must be level and sturdy prior to continuing to Step 4.

**Step 4:** Carefully place Nova C on top of the Nova C Tower Pedestal ensuring the leg pad holes are aligned with the holes on top of the pedestal. The front of the Nova C should face the same direction as the wood storage opening of the pedestal.



**Step 5:** Using a socket or adjustable wrench, secure the Nova C stove to the Nova C Tower Pedestal from the underside using the four bolts and four washers provided. At this point, Nova C should be very secure to the Nova C Tower Pedestal.



**Step 6:** Using gloves, place the piece of ceramic fiberboard insulation and sheet metal shield into the top of the pedestal. These next steps will require both hands and the proper order of operations to complete properly. NOTE: some models use two ½” pieces of insulation and other use a single piece of 1” insulation



**Step 7:** While facing the pedestal, first place the metal shield and insulation directly on top of the fixed clips on the left-hand side. Next, the metal shield and insulation should be elevated above the clip holders on the right-hand side. Then, using your other hand, slide the two clips into place as shown in the pictures below. The metal shield can then be set down on top of the clips



**Step 8:** To insert the removable ash tray, simply slide between the bottom of the stove and the top of the pedestal, as shown below.



To remove the tray, insert the included ash tray handle as shown below, and slide partially out. The same handle can be used to push the tray back into place. When not in use, the ash tray handle may be stored inside the pedestal base.





## Appendix B: Lifetime Limited Warranty

To register your stove, go to [mffire.com/myproduct](http://mffire.com/myproduct). Please provide pictures of your beautiful new installation. Specific exclusions to this warranty are paint, gasket, glass, fasteners, and fire bricks. This warranty is subject to sections A and B. Mileage/labor charges, unless specified below, are not covered by warranty. Labor charges are subject to defined maximum limits by MF Fire. Additional service charges above the defined maximum limits may be charged by the service technician.

Component	Coverage Period			Labor Coverage Period
	Limited Lifetime	5 years	2 years	Years
Firebox, door frame (welds only)	✓			5
Tower or Bench assembly	✓			
Insert Surround Kit assembly	✓			
Bypass plate assembly		✓		2
Bypass handle		✓		2
Catalytic combustor (N11)	✓			
Combustor swing door assembly			✓	1
Air duct(s)			✓	2
Ash lip			✓	2
Ash pan			✓	1
Front door handle assembly			✓	1
Wooden door handle			✓	1
Room blower fan and associated components			✓	1
AES insulation		✓		2
Fire brick retainers			✓	2
Ash retainer		✓		2
Cast iron legs		✓		2
All components not mentioned above are subject to a one-year warranty coverage period.				

#### A. If warranty service is needed

1. If you discover a problem that you believe is covered by this warranty, you must report it to the place of purchase WITHIN 30 DAYS, indicating model name and serial number.
2. MF Fire has the option of either repairing or replacing the defective component.
3. Any appliance or part thereof that is repaired or replaced during the limited warranty period will be warranted under the terms of the original limited warranty for a period not to exceed the remaining term of the original limited warranty.

#### B. Conditions and Exclusions

1. This device must be installed, operated, and maintained at all times in accordance with the instructions in the Owner's Manual. Any alteration, willful abuse, accident, neglect, or misuse of the product shall nullify this warranty.
2. This warranty only applies to the initial owner and residence as registered. A wood stove that has been resold or relocated is not covered under warranty.
3. Discoloration and minor expansion, contraction, or movement of certain parts and potential resulting noise, is normal and not a defect and, therefore, not covered under warranty.
4. This warranty does not cover misuse of the stove. Misuse includes over-firing or use of any fuel not recommended by the manual. Misuse of the wood stove can cause serious damage and will void the warranty.
5. Damage to the appliance while it is in transit is not covered by this warranty but is subject to a claim against the carrier.
6. The warranty, as outlined within this document, does not apply to the chimney components or other accessories used in conjunction with the installation or use of the stove.
7. MF Fire is not responsible for inadequate performance caused by environmental conditions.
8. Limited Lifetime is defined as up to seven years.
9. Exclusions to this lifetime limited warranty include: injury, loss of use, damage, failure to function due to accident, negligence, misuse, improper installation, alteration or adjustment of the manufacturer's settings of components, lack of proper and regular maintenance, damage incurred while the appliance is in transit, alteration, or act of God.
10. Damage to surfaces caused by fingerprints, scratches, melted items, or other external sources left on the surfaces from the use of abrasive cleaners is not covered in this warranty.
11. Damage to the surfaces from over-firing is not covered in this warranty.

12. MF Fire is free of liability for any damages caused by the appliance, as well as inconvenience expenses and materials. Incidental or consequential damages are not covered by this warranty.
13. This warranty does not cover any loss or damage incurred by the use or removal of any component or apparatus to or from the Nova.
14. Any statement or representation of products and their performance contained in MF Fire advertising, packaging literature, or printed material is not part of this limited lifetime warranty.
15. MF Fire will not cover the cost of the removal or re-installation of hearths, facing, mantels, venting or other components.
16. This lifetime warranty is the only warranty supplied by MF Fire, the manufacturer of the appliance. All other warranties, whether express or implied, are hereby expressly disclaimed and purchaser's recourse is expressly limited to the warranties set forth herein.

## **7. QUALITY ASSURANCE / QUALITY CONTROL**

MF Fire, Inc.  
Model: Nova C  
0552WS003E

## Archived Test Specimen

The tested unit was sealed by OMNI-Test Laboratories after the completion of certification testing. This unit will be stored at the manufacturer's premises in the sealed state until 5 years after the certification testing at the following address:

MF Fire, Inc.  
3031 Washington Boulevard  
Suite G  
Baltimore, MD 21230  
USA



**Unit Archived at OMNI Prior to Shipment Back to the Manufacturer**

# Equipment and Calibrations

## ASTM E2515, ASTM E2780

ID #	Lab Name/Purpose	Log Name	Attachment Type
132	10 lb Weight	Weight Standard, 10 lb.	Calibration Certificate
185	Pro-Dec Scale with Electronic Indicator (1000Lb's)	WI-127 1000x0.1 lb	Calibration Certificate 07/2024
715	Digital Barometer	Traceable Barometer	Calibration Certificate 12/13/2023
283A	Audit Weights	Troemner 21pc Mass Set	Calibration Certificate 10/26/2023
335	Sample Box / Dry Gas Meter	Apex Automated Emissions Sampling Box	Calibration Log 03/18/2024
336	Sample Box / Dry Gas Meter	Apex Automated Emissions Sampling Box	Calibration Log 03/18/2024
410	Microtector	Dwyer Microtector	Calibration Certificate 04/06/2024
721	Anemometer	Hot Wire anemometer	Calibration Certificate 12/05/2023
709	RH-81 Humidity Meter	RH-81 Humidity Meter	Calibration Log 02/22/2024
594	Combustion Gas Analyzer	CAI Gas Analyzer - CO <sub>2</sub> - O <sub>2</sub> - and Dual Range CO	(VBU) <sup>1</sup>
637	Milligram Balance	Analytical Balance - Mettler - Toledo	Calibration Certificate 02/2024
371	Sample Box / Dry Gas Meter	Method 6 - Source Sampler	Calibration Log 03/14/2024
372	Sample Box / Dry Gas Meter	Method 6 - Source Sampler	Calibration Log 03/14/2024
430	Moisture Calibrator	Delmhorst moisture Content Standard	Calibration Certificate (11/12/2023)
353	Platform Scale	MTW-150K	Calibration Log 11/30/22 Calibration Certificate (8/10/23)

VBU<sup>1</sup> – Verified with NIST Traceable Gas Cylinders

# SCALE WEIGHT CALIBRATION DATA SHEET

Weight to be calibrated: 10 lbs

ID Number: OMNI-00132

Reference Standard Weight: 10 lbs

ID Number: OMNI-00255

Scale Used: MTW-150K

ID Number: OMNI-00353

Date: 02/15/2023 By: Tony Tong

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

Acceptable tolerance is 1%.

This calibration is traceable to NIST using calibrated standard weight.

Technician signature: *Tony Tong*

Date: 02/15/2023



# QUALITY CONTROL SERVICES

LABORATORY EQUIPMENT • SALES • SERVICE • CALIBRATION • REPAIRS  
2340 SE 11<sup>TH</sup> Ave. Portland, Oregon 97214 • Box 14831 Portland, Oregon 97293  
(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com



OMNI-Test Laboratories, Inc.  
13327 NE Airport Way  
Portland, OR 97230

Report Number: OMNE03005547230907

## A2LA ACCREDITED CERTIFICATE OF CALIBRATION WITH DATA

### INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Scale	Weigh-Tronix	WI-127 1000x0.1lb	005547	OMNI-00185	Lab
Units	Readability	SOP	Cal Date	Last Cal Date	Cal Due Date
lbs	0.1	QC033	9/7/23	9/1/22	9/2024

### FUNCTIONAL CHECKS

SHIFT TEST		LINEARITY		REPEATABILITY		ENVIRONMENTAL CONDITIONS		
Test Wt:	Tol:	Test Wt:	Tol:	Test Wt:	Tol:	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
250	0.4	HB44	HB44	50	0.2	Good	Fair	Poor
As-Found:		As-Found:		As-Found:		Temperature: 23.4°C		
Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>			
As-Left:		As-Left:		As-Left:				
Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>			

### CALIBRATION DATA

Standard	As-Found	As-Left	Expanded Uncertainty
1000	1000.3	1000.2	0.05
700	700.2	700.1	0.05
500	500.2	500.1	0.05
200	200.1	200.0	0.05
100	100.1	100.0	0.05
50	50.1	50.0	0.05

### CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Avoirdupois Cast W	Rice Lake	25 and 50lb	PWO990-CA	7/18/22	7/2024	20221688

**Permanent Information Concerning this Equipment:**  
Old s/n 21676

**Comments/Information Concerning this Calibration**  
9/23 RH= 47.4%

Report prepared/reviewed by: R.B. Date: 9-7-23

Technician: R. Butcher  
Signature: R. Butcher

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

The uncertainty is calculated according to the ISO Guide to the Expression of Uncertainty in Measurement and includes the uncertainty of standards used combined with the observed standard deviation of the unit under test. The uncertainty is expanded with a k factor of 2 for an approximate 95% level of confidence. 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. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.





Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001



Cert. No.: 6530-13313960

**Traceable® Certificate of Calibration for Digital Barometer**

Manufactured for and distributed by : Traceable® Products 12554 Galveston Rd B230, Webster, TX 77598

**Instrument Identification:**

Model: 6530,68000-49

S/N: 221461542

Manufacturer: Control Company

**Standards/Equipment:**

Description	Serial Number	Due Date	NIST Traceable Reference
Digital Barometer	D4540001	29 Nov 2022	1000474068
Chilled Mirror Hygrometer	44654/2H3737	13 Dec 2023	19994
Climate Chamber	W619.0019		
Digital Thermometer	210888692	18 Oct 2022	12739668

**Certificate Information:**

Technician: 57

Procedure: CAL-31

Cal Date: 19 Apr 2022

Cal Due Date: 19 Apr 2024

Test Conditions: 48.96%RH 24.99°C 1020mBar

**Calibration Data: (New Instrument)**

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
%RH	N.A.	N.A.		50.09	51	Y	47	53	0.74	>4:1
°C	N.A.	N.A.		25.31	25.2	Y	24.91	25.71	0.05	>4:1
mb/hPa	N.A.	N.A.		805.80	806	Y	802	810	0.62	>4:1
mb/hPa	N.A.	N.A.		910.03	911	Y	906	914	0.62	>4:1
mb/hPa	N.A.	N.A.		1020.35	1021	Y	1016	1024	0.62	>4:1

This certificate indicates Traceability to standards provided by (NIST) National Institute of Standards and Technology and/or a National Standards Laboratory.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement": (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ± U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=±(Max-Min)/2; Min=As Left Nominal(Rounded) - Tolerance; Max= As Left Nominal(Rounded) + Tolerance;

*Nicol Rodriguez*

Nicol Rodriguez, Quality Manager

*Marisa Elms*

Marisa Elms, Technical Manager

Note :

**Maintaining Accuracy:**

In our opinion once calibrated your Digital Barometer should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Digital Barometer change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

**Recalibration:**

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

Issue Date : 19 Apr 2022

**CONTROL COMPANY 12554 Galveston RD Suite B230 Webster TX USA 77598**  
**Phone 281 482-1714 Fax 281 482-9448 sales@control3.com www.traceable.com**

Control Company is an ISO/IEC 17025:2017 Calibration Laboratory Accredited by (A2LA) American Association for Laboratory Accreditation, Certificate No. 1750.01.  
 Control Company is ISO 9001:2015 Quality Certified by DNV GL, Certificate No. CERT-01805-2006-AQ-HOU-ANAB.  
 International Laboratory Accreditation Cooperation - Multilateral Recognition Arrangement (ILAC-MRA).

# Certificate of Calibration



**JJ Calibrations, Inc.**

7007 SE Lake Rd  
Portland, OR 97267-2105  
Phone 503.786.3005  
FAX 503.786.2994

Certificate Number: **685888**

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



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

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**

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**

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	*Error	UUT	Uncertainty
<b>Before/After</b>	<b>Mass</b>								Accredited = ✓
	<b>Dot</b>	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	4.9996684 g	1.7E-03 ✓
		10 g		10.0000100	9.998010	10.002010	0.000245	9.999765 g	2.3E-03 ✓
<b>Dot</b>		20 g		20.0000140	19.998014	20.004014	0.000950	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: 606001  
 OMNI Tracking No.: OMNI-000335  
 Calibrated Orifice:  Yes

**Average Gas Meter y  
Factor**  
**1.016**

**Orifice  
Meter  
dH@**  
**N/A**

Calibration Date: 09/18/23  
 Calibrated by: Tony Tong  
 Calibration Frequency: Six Month  
 Next Calibration Due: 3/18/2024  
 Instrument Range: 1.000 cfm  
 Standard Temp.: 68 oF  
 Standard Press.: 29.92 "Hg  
 Barometric Press., Pb: 30.08 "Hg  
 Signature/Date: Tony Tong 09/19/2023

### Previous Calibration Comparison

Date	4/27/2023	Acceptable Deviation (5%)	Deviation
y Factor	1.007	0.05035	0.009
Acceptance	<b>Acceptable</b>		

### Current Calibration

Acceptable y Deviation	0.020
Maximum y Deviation	0.003
Acceptable dH@ Deviation	N/A
Maximum dH@ Deviation	N/A
Acceptance	<b>Acceptable</b>

Reference Standard *		
Standard	Model	Standard Test Meter
Calibrator	S/N	OMNI-00330
	Calib. Date	13-Apr-23
	Calib. Value	1.0017 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	1.26	1.00
Initial Reference Meter	380.314	387.061	393.677
Final Reference Meter	386.864	393.561	400.047
Initial DGM	0	0	0
Final DGM	6.471	6.497	6.39
Temp. Ref. Meter (°F), Tr	76.1	76.6	77.7
Temperature DGM (°F), Td	81.0	86.0	87.0
Time (min)	32.0	40.0	44.0
Net Volume Ref. Meter, Vr	6.550	6.500	6.370
Net Volume DGM, Vd	6.471	6.497	6.39
<b>Gas Meter y Factor =</b>	<b>1.018</b>	<b>1.017</b>	<b>1.013</b>
<b>Gas Meter y Factor Deviation (from avg.)</b>	0.002	0.001	0.003
<b>Orifice dH@</b>	N/A	N/A	N/A
<b>Orifice dH@ Deviation (from avg.)</b>	N/A	N/A	N/A

where:

1. Deviation = |Average value for all runs - current run value|
- \*\* 2.  $y = [Vr \times (y \text{ factor (ref)}) \times (Pb + (Pr / 13.6)) \times (Td + 460)] / [Vd \times (Pb + (Pd / 13.6)) \times (Tr + 460)]$
- \*\* 3.  $dH@ = 0.0317 \times Pd / (Pb (Td + 460)) \times [(Tr + 460) \times \text{time}] / Vr ]^2$

\* 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  $\pm 0.14 \text{ ft}^3/\text{min}$ . This is based on the reference standard having a TAR (Test Accuracy Ratio) of at least 4:1.

## DIFFERENTIAL PRESSURE GAUGE CALIBRATION DATA SHEET

Instrument to be calibrated: Pressure Transducer (Draft)

Maximum Range: 0 – 1" H<sub>2</sub>O

ID Number: OMNI-00335

Calibration Instrument: Digital Manometer

ID Number: OMNI-00633

Date: 09/18/2023

By: Tony Tong

**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 0.0 – 0.2	0.101	0.103	0.002	0.2
20-40% Max. Range 0.2– 0.4	0.230	0.232	0.002	0.2
40-60% Max. Range 0.4 – 0.6	0.463	0.465	0.002	0.2
60-80% Max. Range 0.6 – 0.8	0.728	0.730	0.002	0.2
80-100% Max. Range 0.8 – 1.0	0.943	0.945	0.002	0.2

\*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: Tony Tong

Date: 09/19/2023

Reviewed by: \_\_\_\_\_

Date: \_\_\_\_\_

Temperature Calibration EPA Method 28 R, ASTM 2515							
Booth:		Temperature Monitor Type:			Equipment Number:		
E 1		National Instruments Logger			00335, 00336		
Reference Meter Number: 00373				Calibration Due Date: 10/23/2023			
Calibration Performed By:			Date:	Ambient Temperature(F°):		Barometric Pressure(inHg):	
Tony Tong			09/18/2023	75.2		30.09	
Input Temp (°F)	Ambient	Meter A	Meter B	Filter A	Filter B	Tunnel	FB Interior
0	1	1	1	1	1	0	0
100	101	101	101	101	101	100	100
300	301	301	301	301	301	300	300
500	501	501	501	501	501	500	500
700	701	701	701	701	701	700	700
1000	1001	1001	1001	1001	1001	1001	1001
1500	1501	1501	1501	1501	1501	1501	1501
2000	2002	2002	2002	2001	2002	2001	2001

Input (°F)	FB Top	FB Bottom	FB Back	FB Left	FB Right	Imp A	Imp B	Cat	Stack
0	0	0	0	0	0	1	1	1	0
100	100	100	100	100	100	100	101	101	100
300	300	300	300	300	300	301	301	300	300
500	500	500	500	500	500	501	501	501	500
700	700	700	700	700	700	701	701	701	700
1000	1001	1001	1001	1001	1001	1001	1001	1001	1001
1500	1501	1501	1501	1501	1501	1501	1501	1501	1501
2000	2001	2001	2001	2001	2001	2002	2002	2001	2001

Technician Signature: Tony Tong Date: 09/19/2023

Reviewed By: \_\_\_\_\_ Date: \_\_\_\_\_

# Thermal Metering System Calibration

## Y Factor

Manufacturer: Apex  
 Model: XC-60-EP  
 Serial Number: 606001  
 OMNI Tracking No.: OMNI-00336  
 Calibrated Orifice:  Yes

**Average Gas Meter y Factor**  
**1.011**

**Orifice Meter dH@**  
**N/A**

Calibration Date: 09/18/23  
 Calibrated by: Tony Tong  
 Calibration Frequency: Six Month  
 Next Calibration Due: 3/18/2024  
 Instrument Range: 1.000 cfm  
 Standard Temp.: 68 oF  
 Standard Press.: 29.92 "Hg  
 Barometric Press., Pb: 30.06 "Hg  
 Signature/Date: Tony Tong 09/19/2023

### Previous Calibration Comparison

Date	4/27/2023	Acceptable Deviation (5%)	Deviation
y Factor	1.015	0.05075	0.004
Acceptance	<b>Acceptable</b>		

### Current Calibration

Acceptable y Deviation	0.020
Maximum y Deviation	0.002
Acceptable dH@ Deviation	N/A
Maximum dH@ Deviation	N/A
Acceptance	<b>Acceptable</b>

Reference Standard *		
Standard	Model	Standard Test Meter
Calibrator	S/N	OMNI-00330
	Calib. Date	13-Apr-23
	Calib. Value	1.0017 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	1.93	0.96	0.75
Initial Reference Meter	401.417	406.87	412.46
Final Reference Meter	406.732	412.324	417.96
Initial DGM	0	0	0
Final DGM	5.292	5.483	5.528
Temp. Ref. Meter (°F), Tr	77.9	78.4	78.3
Temperature DGM (°F), Td	83.0	86.0	88.0
Time (min)	24.0	34.0	38.0
Net Volume Ref. Meter, Vr	5.315	5.454	5.500
Net Volume DGM, Vd	5.292	5.483	5.528
<b>Gas Meter y Factor =</b>	<b>1.011</b>	<b>1.008</b>	<b>1.013</b>
<b>Gas Meter y Factor Deviation (from avg.)</b>	0.000	0.002	0.002
<b>Orifice dH@</b>	N/A	N/A	N/A
<b>Orifice dH@ Deviation (from avg.)</b>	N/A	N/A	N/A

where:

1. Deviation = |Average value for all runs - current run value|
- \*\* 2.  $y = [Vr \times (y \text{ factor (ref)}) \times (Pb + (Pr / 13.6)) \times (Td + 460)] / [Vd \times (Pb + (Pd / 13.6)) \times (Tr + 460)]$
- \*\* 3.  $dH@ = 0.0317 \times Pd / (Pb (Td + 460)) \times [(Tr + 460) \times \text{time}] / Vr ]^2$

\* 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  $\pm 0.14 \text{ ft}^3/\text{min}$ . This is based on the reference standard having a TAR (Test Accuracy Ratio) of at least 4:1.

## DIFFERENTIAL PRESSURE GAUGE CALIBRATION DATA SHEET

Instrument to be calibrated: Pressure Transducer ( $\Delta P$ )

Maximum Range: 0 – 1" H<sub>2</sub>O

ID Number: OMNI-00336

Calibration Instrument: Digital Manometer

ID Number: OMNI-00633

Date: 09/18/2023

By: Tony Tong

**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 0.0 – 0.2	0.096	0.100	0.004	0.4
20-40% Max. Range 0.2– 0.4	0.258	0.262	0.004	0.4
40-60% Max. Range 0.4 – 0.6	0.462	0.467	0.005	0.5
60-80% Max. Range 0.6 – 0.8	0.735	0.742	0.007	0.7
80-100% Max. Range 0.8 – 1.0	0.961	0.969	0.008	0.8

\*Acceptable tolerance is 4%.

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

Technician signature: Tony Tong

Date: 09/19/2023

Reviewed by: \_\_\_\_\_

Date: \_\_\_\_\_

Temperature Calibration EPA Method 28 R, ASTM 2515							
Booth:		Temperature Monitor Type:			Equipment Number:		
E 1		National Instruments Logger			00335, 00336		
Reference Meter Number: 00373				Calibration Due Date: 10/23/2023			
Calibration Performed By:			Date:	Ambient Temperature(F°):		Barometric Pressure(inHg):	
Tony Tong			09/18/2023	75.2		30.09	
Input Temp (°F)	Ambient	Meter A	Meter B	Filter A	Filter B	Tunnel	FB Interior
0	1	1	1	1	1	0	0
100	101	101	101	101	101	100	100
300	301	301	301	301	301	300	300
500	501	501	501	501	501	500	500
700	701	701	701	701	701	700	700
1000	1001	1001	1001	1001	1001	1001	1001
1500	1501	1501	1501	1501	1501	1501	1501
2000	2002	2002	2002	2001	2002	2001	2001

Input (°F)	FB Top	FB Bottom	FB Back	FB Left	FB Right	Imp A	Imp B	Cat	Stack
0	0	0	0	0	0	1	1	1	0
100	100	100	100	100	100	100	101	101	100
300	300	300	300	300	300	301	301	300	300
500	500	500	500	500	500	501	501	501	500
700	700	700	700	700	700	701	701	701	700
1000	1001	1001	1001	1001	1001	1001	1001	1001	1001
1500	1501	1501	1501	1501	1501	1501	1501	1501	1501
2000	2001	2001	2001	2001	2001	2002	2002	2001	2001

Technician Signature: Tony Tong Date: 09/19/2023

Reviewed By: \_\_\_\_\_ Date: \_\_\_\_\_



# Certificate of Calibration

Certificate Number: 788484



**JJ Calibrations, Inc.**  
 7724 SE Aspen Summit Drive  
 Portland, OR 97266-9217  
 Phone 503.786.3005  
 FAX 503.786.2994

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

PO: 230420  
 Order Date: 02/16/2023  
 Authorized By: N/A



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

Calibrated on: 04/06/2023  
 \*Recommended Due: 04/06/2024  
 Environment: 19 °C 37 % 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 the micrometer head calibrated only, continued. Unit was received and returned in a case.

## Standards Used

Std ID	Manufacturer	Model	Nomenclature	Due Date	Trace ID
913A	Starrett	SS88. A1	Gage Block Set, 88 Pieces	07/29/2023	776002

Parameter Measurement Description	Range Unit	Measurement Data				UUT	Uncertainty Accredited = ✓
		Reference	Min	Max	*Error		
Before/After Length	Inch	0.1300	0.129	0.131	0.000	0.130 Inch	2.5E-05 ✓
	Inch	0.3850	0.384	0.386	0.000	0.385 Inch	2.5E-05 ✓
	Inch	0.6150	0.614	0.616	0.000	0.615 Inch	2.5E-05 ✓
	Inch	0.8700	0.869	0.871	0.000	0.870 Inch	2.5E-05 ✓
	Inch	1.0000	0.999	1.001	0.000	1.000 Inch	2.5E-05 ✓

This instrument has been calibrated in accordance with the JJ Calibrations Quality Assurance Manual and is traceable to either the SI or to National Institute of Standards and Technology (NIST). The quality system and this certificate are in compliance with ANSI/NCSL Z540-1-1994, ISO/IEC 17025-2017, 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 stated in the comments, certificates reflect the "Simple Acceptance Rule" as specified by JCGM 106:2012. 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 written approval of JJ Calibrations.

Reviewer

3 Issued 04/07/2023

Rev # 15

Inspector

625 East Bunker Court  
Vernon Hills, Illinois 60061  
Ph: 866-466-6225  
Fax: 847-327-2993  
www.innocalsolutions.com

*NIST Traceable*  
**Calibration Report**

REPORT NUMBER  
**1713519**

Reference Number: MUB285900  
PO Number: MUB285900

**Cole-Parmer**  
625 E Bunker Ct  
Vernon Hills, IL 60061-1844 United States



**Manufacturer:** Digi-Sense  
**Model Number:** 20250-16  
**Description:** Air Velocity, Hot Wire Anemometer  
**Asset Number:** CP202636  
**Serial Number:** 220723100  
**Procedure:** DS Digi-Sense 20250-16

**Calibration Date:** 12/05/2022  
**Calibration Due Date:**  
**Condition As Found:** Initial Calibration  
**Condition As Left:** In Tolerance, No adjustment

**Remarks:**  
NIST-traceable calibration performed on the unit referenced above in accordance with customer requirements, published specifications and the lab's standard operating procedures. No adjustments were made to the unit. Recommended calibration due date is 12 months from date of purchase.

**Standards Used**

Standard ID	Manufacturer	Model Number	Description	Cal Date	Due Date
CP105979	Kanomax	X5602	Air Velocity, Wind Tunnel, Open Jet	5/11/2022	5/31/2023
CP105914	Fluke Corporation	1551A EX	Temperature, Stik Thermometer	7/26/2022	7/31/2023

**Calibration Data**

Function Tested	Nominal / Reference Value	Measured Value	OOT	Calibration Tolerance <i>p = Guard Banding Applied</i>	TUR	EMU
<b>Air Velocity Accuracy</b>	5.00 m/s					
As Found & As Left	5.00	5.05		4.74 to 5.26 m/s	8.2:1	± 0.042 m/s
	10.00 m/s					
As Found & As Left	10.00	10.06		9.48 to 10.51 m/s	11:1	± 0.045 m/s
	15.00 m/s					
As Found & As Left	15.00	15.13		14.24 to 15.76 m/s	8.1:1	± 0.094 m/s
	20.00 m/s					
As Found & As Left	20.00	20.51		18.99 to 21.01 m/s	8.1:1	± 0.12 m/s
	25.00 m/s					
As Found & As Left	25.00	25.67		23.74 to 26.26 m/s	8.1:1	± 0.16 m/s
<b>Temperature Accuracy</b>	25.0 °C					
As Found & As Left	25.0	25.2		24.0 to 26.0 °C	13:1	± 0.077 °C

**Temperature:** 21 °C  
**Humidity:** 21 %RH  
**Rpt. No.:** 1713519

Calibration Performed By:				Quality Reviewer:	
Trevor Sass	Metrologist			James Alexander	12/5/2022
<small>Name</small>	<small>ID #</small>	<small>Title</small>	<small>Phone</small>	<small>Name</small>	<small>Date</small>

This report may not be reproduced, except in full, without written permission of InnoCal. The results stated in this report apply only to the items tested or calibrated. Measurements reported herein are traceable to SI units via national standards maintained by NIST and were performed in conformance with MIL-STD-45662A, ANSI/INCISL 2649-1-1994, 10 CFR 850, Appendix B, ISO 9002-94, and ISO 17025:2017. Conformance based on Single Acceptance as a Decision Rule. The estimated measurement uncertainty (EMU), if reported on this certificate, is being reported at a confidence level of 95% or K=2 unless otherwise noted in the remarks section.

# Certificate of Calibration

Certificate Number: 788485



**JJ Calibrations, Inc.**  
 7724 SE Aspen Summit Drive  
 Portland, OR 97266-9217  
 Phone 503.786.3005  
 FAX 503.786.2994

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

PO: 230420  
 Order Date: 02/16/2023  
 Authorized By: N/A



Calibrated on: 03/06/2023  
 \*Recommended Due: 03/06/2028  
 Environment: 23 °C 35 % RH  
 \* As Received: Within Tolerance  
 \* As Returned: Within Tolerance  
 Action Taken: Calibrated  
 Technician: 173

Property #: OMNI-00709  
 User: N/A  
 Department: N/A  
 Make: Omega  
 Model: RH81  
 Serial #: 10361019

Description: Thermohygrometer  
 Procedure: DCN 401013/403410  
 Accuracy: RH ±3%, TEMP ±1°C(±1.8°F)

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
925A	RH Systems	CGS- 240	Humidity Generator	02/22/2024	789080

## Measurement Data

Parameter	Measurement Description	Range	Unit	Reference	Min	Max	*Error	UUT	Uncertainty
<b>Before/After</b> Relative Humidity									Accredited = ✓
		RH		25.00	22.0	28.0	0.3	25.3 RH	6.3E-01 ✓
		RH		50.00	47.0	53.0	1.3	48.7 RH	6.3E-01 ✓
		RH		75.00	72.0	78.0	0.7	74.3 RH	6.3E-01 ✓
<b>Temperature</b>									
			°C	20.0	19	21	0	20 °C	2.8E-01 ✓
			°C	30.00	29.0	31.0	0.6	29.4 °C	2.8E-01 ✓
			°C	40.60	39.6	41.6	0.4	40.2 °C	2.8E-01 ✓

This instrument has been calibrated in accordance with the JJ Calibrations Quality Assurance Manual and is traceable to either the SI or to National Institute of Standards and Technology (NIST). The quality system and this certificate are in compliance with ANSI/NCCL Z540-1-1994, ISO/IEC 17025-2017, 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 stated in the comments, certificates reflect the "Simple Acceptance Rule" as specified by JCGM 106:2012. 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 written approval of JJ Calibrations.

Reviewer

3 Issued 03/08/2023

Rev # 15

Inspector



Praxair Distribution, Inc.  
5700 S. Alameda St.  
Los Angeles, CA 90058  
Tel: 877-PRAXAIR  
Fax: 610-758-9103

12/19/2017

PXPKG TUALATIN OR H  
10450 SW TUALATIN SHERWOOD ROAD  
TUALATIN, OR 97062  
Attention: PXPKG TUALATIN OR H

Work Order No. **70442480**  
Customer Reference No.

Product Lot/Batch No. **70086734603**  
Product Part No. **NI CD15C5P-AS**

**CERTIFICATE OF ANALYSIS**  
*Primary Standard*

Component	Requested Concentration	Certified Concentration	Analytical Principle	Analytical Uncertainty
Carbon dioxide	15 %	15.00 %	V	±0.02%abs
Carbon monoxide	500 ppm	501 ppm	V	±1%
Nitrogen	balance	balance		

Analytical Instruments: **Mettler-ID5-V - Gravimetric-Gravimetric**  
 Cylinder Style: **AS** Filling Method: **Gravimetric**  
 Cylinder Pressure @70F: **2000 psig** Date of Fill: **12/12/2017**  
 Cylinder Volume: **150 ft3** Expiration Date: **12/18/2022**  
 Valve Outlet Connection: **CGA-350**  
 Cylinder No(s): **DT0022750**

Analyst: **Jose Vasquez**

Approved Signer: **Nelson Ma**

The gas calibration cylinder standard prepared by Praxair Distribution, Inc. is considered a certified standard. It is prepared by gravimetric, volumetric, or partial pressure techniques. The calibration standard provided is certified against Praxair Distribution, Inc. Reference Materials which are either prepared by weights traceable to the National Institute of Standards and Technology (NIST), Measurement Canada, or by using NIST Standard Reference Materials where available.

Note: All expressions for concentration (e.g., % or ppm) are for gas phase, by volume (e.g., ppmV), unless otherwise noted.

Key to Analytical Techniques			
A	Flame Ionization with Methane Ion Detector	B	Gas Chromatography with Discharge Ionization Detector
C	Gas Chromatography with Electron Capture Detector	D	Gas Chromatography with Flame Ionization Detector
E	Gas Chromatography with Photoionization Detector	F	Gas Chromatography with Nitrogen Ionization Detector
G	Gas Chromatography with Methane Ion Detector	H	Gas Chromatography with Photoionization Detector
I	Gas Chromatography with Redox Gas Analyzer Detector	J	Gas Chromatography with Thermal Conductivity Detector
K	Density Gas Analyzer with Thermal Conductivity Detector	L	Infrared - FTIR or NDIR
M	Mass Spectrometry - MS or GC/MS	N	By Difference of Typical Impurities
O	Permeation	P	Specific Water Analyzer
Q	Total Hydrocarbon Analyzer	R	Wet Chemical
S	Submergence	T	Other
U	Chemical Analysis	V	Gravimetric
W	Linear Spectroscopy	X	Electrolytic Cell/Electrochemical
Y		Z	UV Spectroscopy

**IMPORTANT**  
The information contained herein has been prepared at your request by personnel within Praxair Distribution, Inc. While we believe the information is accurate within the limits of the analytical methods employed and is complete to the extent of the specific analyses performed, we make no warranty or representation as to the suitability of the use of the information for any particular purpose. The information is offered with the understanding that any use of the information is at the sole discretion and risk of the user. In no event shall liability of Praxair Distribution, Inc. arising out of the use of the information contained herein exceed the fee established for providing such information.



Making our world  
more productive

Received  
5/1/2023

Doc Number: 538809



Linde Gas & Equipment Inc.  
5700 S. Alameda Street  
Los Angeles CA 90058  
Tel: 323-585-2154  
Fax: 714-542-4689  
PGVP ID: F22023

# CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information  
LORDS TULATIN OR H  
1045 SW TULATIN SHERWOOD ROAD  
TULATIN OR 97082-4647

Certificate Number: 04252023  
Linde Order Number: 72407928  
Part Number: R10110000-AS  
Customer PO Number: 8029367

Fit Date: 04/15/2023  
Lot Number: 7080310588  
Cylinder Size & Color: CGA-580  
Cylinder Pressure and Volume: 1300 psig 99.83

ProSpec EZ Cert



## Certified Concentration

Expiration Date:	04252031	NIST Traceable
Cylinder Number:	CC241056	Expanded Uncertainty
Carbon dioxide		± 0.09 %
Carbon monoxide		± 0.03 %
Oxygen		± 0.05 %
Balance		
Nitrogen		

## Certification Information:

Certification Date: 04/25/2023

Term: 96 Months

Expiration Date: 04/25/2031

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document (EPA-600/R-12/23), using Procedure G1. Uncertainty shown is expressed as absolute expanded uncertainty at a level of confidence of approximately 95% with a coverage factor k = 2. Do Not Use this Standard if Pressure is less than 100 PSIG.

CO responses have been corrected for CO interference. CO responses have been corrected for CO2 interference.

## Analytical Data:

(N=)Reference Standard: 2-Zero Gas, C-Gas Cinc./Nex

1. Component: Carbon dioxide

Reference Standard: Type / Cylinder #: NIRM / C072881

Concentration / Uncertainty: 19.34 % ±0.20 %

Requested Concentration: 17 %

Expiration Date: 01/15/2027

Certified Concentration: 16.84 %

Traceable to: SRM # / Sample # / Cylinder # / NIST # / ICD / 28973

Instrument Used: Horiba VMAS-10 SN: 20C1304X

SRM Concentration / Uncertainty: 19.34% / ±0.03%

Analytical Method: NDR

SRM Expiration Date: 01/15/2027

Last Multiport Calibration: 04/21/2023

First Analysis Data:		Date:	04/25/2023
Z:	0	R:	19.34
C:	16.84	C:	16.84
R:	16.84	Z:	0
C:	16.84	R:	19.34
UOM: %		Mean Test Assay: 16.84 %	

Second Analysis Data:		Date:	04/25/2023
Z:	0	R:	19.34
C:	16.84	C:	16.84
R:	16.84	Z:	0
C:	16.84	R:	19.34
UOM: %		Mean Test Assay: 16.84 %	

Reference Standard:		Type / Cylinder #:	NIRM / C072881
Concentration / Uncertainty:	19.34 % ±0.20 %	Expiration Date:	01/15/2027
Traceable to:	SRM # / Sample # / Cylinder # / NIST # / ICD / 28973	SRM Concentration / Uncertainty:	19.34% / ±0.03%
SRM Expiration Date:	01/15/2027	SRM Expiration Date:	01/15/2027

Reference Standard:		Type / Cylinder #:	GM5 / M029287
Concentration / Uncertainty:	20.85 % ±0.02 %	Expiration Date:	09/01/2028
Traceable to:	SRM # / Sample # / Cylinder # / NIST # / ICD / 2231	SRM Concentration / Uncertainty:	20.85% / ±0.02%
SRM Expiration Date:	09/01/2028	SRM Expiration Date:	09/01/2028

Reference Standard:		Type / Cylinder #:	GM5 / M029287
Concentration / Uncertainty:	20.85 % ±0.02 %	Expiration Date:	09/01/2028
Traceable to:	SRM # / Sample # / Cylinder # / NIST # / ICD / 2231	SRM Concentration / Uncertainty:	20.85% / ±0.02%
SRM Expiration Date:	09/01/2028	SRM Expiration Date:	09/01/2028

First Analysis Data:		Date:	04/25/2023
Z:	0	R:	7.81
C:	4.4	C:	4.4
R:	4.4	Z:	0
C:	4.4	R:	7.81
UOM: %		Mean Test Assay: 4.32 %	

Second Analysis Data:		Date:	04/25/2023
Z:	0	R:	7.81
C:	4.4	C:	4.4
R:	4.4	Z:	0
C:	4.4	R:	7.81
UOM: %		Mean Test Assay: 4.32 %	

Reference Standard:		Type / Cylinder #:	GM5 / M029287
Concentration / Uncertainty:	20.85 % ±0.02 %	Expiration Date:	09/01/2028
Traceable to:	SRM # / Sample # / Cylinder # / NIST # / ICD / 2231	SRM Concentration / Uncertainty:	20.85% / ±0.02%
SRM Expiration Date:	09/01/2028	SRM Expiration Date:	09/01/2028

Reference Standard:		Type / Cylinder #:	GM5 / M029287
Concentration / Uncertainty:	20.85 % ±0.02 %	Expiration Date:	09/01/2028
Traceable to:	SRM # / Sample # / Cylinder # / NIST # / ICD / 2231	SRM Concentration / Uncertainty:	20.85% / ±0.02%
SRM Expiration Date:	09/01/2028	SRM Expiration Date:	09/01/2028

First Analysis Data:		Date:	04/25/2023
Z:	0	R:	20.85
C:	16.84	C:	16.84
R:	16.84	Z:	0
C:	16.84	R:	20.85
UOM: %		Mean Test Assay: 16.85 %	

Second Analysis Data:		Date:	04/25/2023
Z:	0	R:	20.85
C:	16.84	C:	16.84
R:	16.84	Z:	0
C:	16.84	R:	20.85
UOM: %		Mean Test Assay: 16.85 %	

Reference Standard:		Type / Cylinder #:	GM5 / M029287
Concentration / Uncertainty:	20.85 % ±0.02 %	Expiration Date:	09/01/2028
Traceable to:	SRM # / Sample # / Cylinder # / NIST # / ICD / 2231	SRM Concentration / Uncertainty:	20.85% / ±0.02%
SRM Expiration Date:	09/01/2028	SRM Expiration Date:	09/01/2028

Reference Standard:		Type / Cylinder #:	GM5 / M029287
Concentration / Uncertainty:	20.85 % ±0.02 %	Expiration Date:	09/01/2028
Traceable to:	SRM # / Sample # / Cylinder # / NIST # / ICD / 2231	SRM Concentration / Uncertainty:	20.85% / ±0.02%
SRM Expiration Date:	09/01/2028	SRM Expiration Date:	09/01/2028

First Analysis Data:		Date:	04/25/2023
Z:	0	R:	20.85
C:	16.84	C:	16.84
R:	16.84	Z:	0
C:	16.84	R:	20.85
UOM: %		Mean Test Assay: 16.85 %	

Second Analysis Data:		Date:	04/25/2023
Z:	0	R:	20.85
C:	16.84	C:	16.84
R:	16.84	Z:	0
C:	16.84	R:	20.85
UOM: %		Mean Test Assay: 16.85 %	

Reference Standard:		Type / Cylinder #:	GM5 / M029287
Concentration / Uncertainty:	20.85 % ±0.02 %	Expiration Date:	09/01/2028
Traceable to:	SRM # / Sample # / Cylinder # / NIST # / ICD / 2231	SRM Concentration / Uncertainty:	20.85% / ±0.02%
SRM Expiration Date:	09/01/2028	SRM Expiration Date:	09/01/2028

Reference Standard:		Type / Cylinder #:	GM5 / M029287
Concentration / Uncertainty:	20.85 % ±0.02 %	Expiration Date:	09/01/2028
Traceable to:	SRM # / Sample # / Cylinder # / NIST # / ICD / 2231	SRM Concentration / Uncertainty:	20.85% / ±0.02%
SRM Expiration Date:	09/01/2028	SRM Expiration Date:	09/01/2028

Analysed By:

Certified By:

Information contained herein has been prepared at your request by qualified persons within Linde Gas & Equipment Inc. While we believe that the information is accurate, we do not warrant the accuracy of the information for any purpose other than the specific use intended. The user is responsible for the use of the information for any purpose other than the specific use intended. The user is responsible for the use of the information for any purpose other than the specific use intended. The user is responsible for the use of the information for any purpose other than the specific use intended.



# QUALITY CONTROL SERVICES

LABORATORY EQUIPMENT • SALES • SERVICE • CALIBRATION • REPAIRS  
 2340 SE 11<sup>TH</sup> Ave. Portland, Oregon 97214 • Box 14831 Portland, Oregon 97293  
 (503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com



OMNI-Test Laboratories, Inc.  
 13327 NE Airport Way  
 Portland, OR 97230

Report Number: OMNE03B729400181230810

## A2LA ACCREDITED CERTIFICATE OF CALIBRATION WITH DATA

### INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Mettler	MS104TS	B729400181	OMNI-00637	Lab
Units	Readability	SOP	Cal Date	Last Cal Date	Cal Due Date
g	0.0001	qcs012	8/10/23	1/30/23	2/2024

### FUNCTIONAL CHECKS

ECCENTRICITY		LINEARITY		STANDARD DEVIATION			ENVIRONMENTAL CONDITIONS
Test Wt:	Tol:	Test Wt:	Tol:	Test Wt:	Tol:		
50	0.0001	20x4	0.0001	100	0.0001		<input type="checkbox"/> Good <input checked="" type="checkbox"/> Fair <input type="checkbox"/> Poor  Temperature: 25.4°C
As-Found:		As-Found:		1. 100.0000	5. 100.0000	9. 100.0000	
Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	2. 100.0000	6. 100.0001	10. 100.0000	
As-Left:		As-Left:		3. 100.0000	7. 100.0000	<u>Result</u>	
Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	4. 100.0000	8. 100.0000	0.00003	

### A2LA ACCREDITED SECTION OF REPORT

Standard	As-Found	As-Left	Expanded Uncertainty
100	100.0004	100.0001	0.00014
80	80.0002	80.0000	0.00014
50	50.0002	50.0001	0.00013
20	20.0001	20.0000	0.00013
1	1.0000	1.0000	0.00013
0.1	0.1000	0.1000	0.00013

### CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	Rice Lake	10 kg to 1 mg	D123	6/15/23	6/2024	20231316

Permanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

8/23 - Cleaned, leveled, & adjusted span. RH = 40%

Report prepared/reviewed by: RB Date: 8-14-23

Technician: D. Oudeans

Signature: R. Butts For D. Oudeans

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

The uncertainty is calculated according to the ISO Guide to the Expression of Uncertainty in Measurement and includes the uncertainty of standards used combined with the observed standard deviation and readability of the unit under test. The uncertainty is expanded with a k factor of 2 for an approximate 95% level of confidence. 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. Calibrations comply with ISO/IEC 17025 and ANSI Z540-1-1994 quality standards.

Member: National Conference of Standards Laboratories and Weights & Measures

# Thermal Metering System Calibration Y Factor

Manufacturer: Apex  
 Model: XC-60-EP  
 Serial Number: 702003  
 OMNI Tracking No.: OMNI-00371  
 Calibrated Orifice:  Yes

**Average Gas Meter y  
Factor**  
**1.015**

**Orifice  
Meter  
dH@**  
**N/A**

Calibration Date: 09/14/23  
 Calibrated by: Tony Tong  
 Calibration Frequency: Six Month  
 Next Calibration Due: 3/14/2024  
 Instrument Range: 1.000 cfm  
 Standard Temp.: 68 oF  
 Standard Press.: 29.92 "Hg  
 Barometric Press., Pb: 30.08 "Hg  
 Signature/Date: Tony Tong / 9/14/2023

### Previous Calibration Comparison

Date	4/27/2023	Acceptable Deviation (5%)	Deviation
y Factor	1.014	0.0507	0.001
Acceptance	<b>Acceptable</b>		

### Current Calibration

Acceptable y Deviation	0.020
Maximum y Deviation	0.006
Acceptable dH@ Deviation	N/A
Maximum dH@ Deviation	N/A
Acceptance	<b>Acceptable</b>

Reference Standard *		
Standard	Model	Standard Test Meter
Calibrator	S/N	OMNI-00330
	Calib. Date	13-Apr-23
	Calib. Value	1.0017 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	3.17	2.20	1.00
Initial Reference Meter	343.578	349.273	354.856
Final Reference Meter	349.022	354.658	360.486
Initial DGM	0	0	0
Final DGM	5.329	5.318	5.604
Temp. Ref. Meter (°F), Tr	76.2	76.1	76.7
Temperature DGM (°F), Td	79.0	79.0	80.0
Time (min)	27.0	33.0	52.0
Net Volume Ref. Meter, Vr	5.444	5.385	5.630
Net Volume DGM, Vd	5.329	5.318	5.604
<b>Gas Meter y Factor =</b>	<b>1.021</b>	<b>1.014</b>	<b>1.010</b>
<b>Gas Meter y Factor Deviation (from avg.)</b>	0.006	0.001	0.005
<b>Orifice dH@</b>	N/A	N/A	N/A
<b>Orifice dH@ Deviation (from avg.)</b>	N/A	N/A	N/A

where:

1. Deviation = |Average value for all runs - current run value|
- \*\* 2.  $y = [Vr \times (y \text{ factor (ref)}) \times (Pb + (Pr / 13.6)) \times (Td + 460)] / [Vd \times (Pb + (Pd / 13.6)) \times (Tr + 460)]$
- \*\* 3.  $dH@ = 0.0317 \times Pd / (Pb (Td + 460)) \times [(Tr + 460) \times \text{time}] / Vr ]^2$

\* 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  $\pm 0.14 \text{ ft}^3/\text{min}$ . This is based on the reference standard having a TAR (Test Accuracy Ratio) of at least 4:1.

## DIFFERENTIAL PRESSURE GAUGE CALIBRATION DATA SHEET

Instrument to be calibrated: Pressure Transducer (Draft)

Maximum Range: 0 – 1" H<sub>2</sub>O

ID Number: OMNI-00371

Calibration Instrument: Digital Manometer

ID Number: OMNI-00633

Date: 09/13/2023

By: Tony Tong

**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 0.0 – 0.2	0.083	0.081	0.002	0.2
20-40% Max. Range 0.2– 0.4	0.239	0.238	0.001	0.1
40-60% Max. Range 0.4 – 0.6	0.452	0.455	0.003	0.3
60-80% Max. Range 0.6 – 0.8	0.726	0.729	0.003	0.3
80-100% Max. Range 0.8 – 1.0	0.942	0.948	0.006	0.6

\*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: Tony Tong

Date: 09/14/2023

Reviewed by: \_\_\_\_\_

Date: \_\_\_\_\_



Temperature Calibration EPA Method 28 R, ASTM 2515							
Booth:		Temperature Monitor Type:			Equipment Number:		
E 1		National Instruments Logger			00371, 00372		
Reference Meter Number: 00373				Calibration Due Date: 10/23/2023			
Calibration Performed By:			Date:	Ambient Temperature(F°):		Barometric Pressure(inHg):	
Tony Tong			09/13/2023	79.9		30.10	
Input Temp (°F)	Ambient	Meter A	Meter B	Filter A	Filter B	Tunnel	FB Interior
0	0	1	0	0	0	1	1
100	100	101	100	100	100	101	101
300	300	300	300	300	300	301	301
500	500	500	500	500	500	501	501
700	700	700	700	700	700	701	701
1000	1000	1000	1000	1000	1000	1001	1001
1500	1500	1502	1500	1501	1500	1501	1501
2000	2000	2000	2001	2000	2001	2001	2001

Input (°F)	FB Top	FB Bottom	FB Back	FB Left	FB Right	Imp A	Imp B	Cat	Stack
0	1	1	1	1	1	0	0	0	1
100	101	101	101	101	101	100	100	100	101
300	301	301	301	301	301	300	300	300	301
500	501	501	501	501	501	500	500	500	501
700	701	701	701	701	701	700	700	700	701
1000	1001	1001	1001	1001	1001	1000	1000	1000	1001
1500	1501	1501	1501	1501	1501	1500	1500	1500	1501
2000	2001	2001	2001	2001	2001	2000	2000	2000	2001

Technician Signature: Tony Tong Date: 09/14/2023

Reviewed By: \_\_\_\_\_ Date: \_\_\_\_\_

# Thermal Metering System Calibration

## Y Factor

Manufacturer: Apex  
 Model: XC-60-EP  
 Serial Number: 702004  
 OMNI Tracking No.: OMNI-00372  
 Calibrated Orifice:  Yes

**Average Gas Meter y Factor**  
**1.011**

**Orifice Meter dH@**  
**N/A**

Calibration Date: 09/14/23  
 Calibrated by: Tony Tong  
 Calibration Frequency: Six Month  
 Next Calibration Due: 3/14/2024  
 Instrument Range: 1.000 cfm  
 Standard Temp.: 68 oF  
 Standard Press.: 29.92 "Hg  
 Barometric Press., Pb: 30.05 "Hg  
 Signature/Date: Tony Tong /09/14/2023

### Previous Calibration Comparison

Date	5/1/2023	Acceptable Deviation (5%)	Deviation
y Factor	1.012	0.0506	0.001
Acceptance	<b>Acceptable</b>		

### Current Calibration

Acceptable y Deviation	0.020
Maximum y Deviation	0.004
Acceptable dH@ Deviation	N/A
Maximum dH@ Deviation	N/A
Acceptance	<b>Acceptable</b>

### Reference Standard \*

Standard	Model	Standard Test Meter
Calibrator	S/N	OMNI-00330
	Calib. Date	13-Apr-23
	Calib. Value	1.0017 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	2.50	1.70	0.75
Initial Reference Meter	360.788	366.597	373.258
Final Reference Meter	366.285	373.11	379.564
Initial DGM	0	0	0
Final DGM	5.431	6.452	6.293
Temp. Ref. Meter (°F), Tr	77.0	77.6	78.0
Temperature DGM (°F), Td	80.0	81.0	81.0
Time (min)	28.0	41.0	64.0
Net Volume Ref. Meter, Vr	5.497	6.513	6.306
Net Volume DGM, Vd	5.431	6.452	6.293
<b>Gas Meter y Factor =</b>	<b>1.013</b>	<b>1.013</b>	<b>1.008</b>
<b>Gas Meter y Factor Deviation (from avg.)</b>	0.002	0.002	0.004
<b>Orifice dH@</b>	N/A	N/A	N/A
<b>Orifice dH@ Deviation (from avg.)</b>	N/A	N/A	N/A

where:

1. Deviation = |Average value for all runs - current run value|
- \*\* 2.  $y = [Vr \times (y \text{ factor (ref)}) \times (Pb + (Pr / 13.6)) \times (Td + 460)] / [Vd \times (Pb + (Pd / 13.6)) \times (Tr + 460)]$
- \*\* 3.  $dH@ = 0.0317 \times Pd / (Pb (Td + 460)) \times [(Tr + 460) \times \text{time}] / Vr ]^2$

\* 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  $\pm 0.14 \text{ ft}^3/\text{min}$ . This is based on the reference standard having a TAR (Test Accuracy Ratio) of at least 4:1.

## DIFFERENTIAL PRESSURE GAUGE CALIBRATION DATA SHEET

Instrument to be calibrated: Pressure Transducer ( $\Delta P$ )

Maximum Range: 0 – 1" H<sub>2</sub>O

ID Number: OMNI-00372

Calibration Instrument: Digital Manometer

ID Number: OMNI-00633

Date: 09/13/2023

By: Tony Tong

**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 0.0 – 0.2	0.104	0.105	0.001	0.1
20-40% Max. Range 0.2– 0.4	0.252	0.254	0.002	0.2
40-60% Max. Range 0.4 – 0.6	0.519	0.524	0.005	0.5
60-80% Max. Range 0.6 – 0.8	0.662	0.669	0.007	0.7
80-100% Max. Range 0.8 – 1.0	0.957	0.967	0.010	1.0

\*Acceptable tolerance is 4%.

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

Technician signature: Tony Tong

Date: 09/14/2023

Reviewed by: \_\_\_\_\_

Date: \_\_\_\_\_

Temperature Calibration EPA Method 28 R, ASTM 2515							
Booth:		Temperature Monitor Type:				Equipment Number:	
E 1		National Instruments Logger				00371, 00372	
Reference Meter Number: 00373				Calibration Due Date: 10/23/2023			
Calibration Performed By:			Date:	Ambient Temperature(F°):		Barometric Pressure(inHg):	
Tony Tong			09/13/2023	79.9		30.10	
Input Temp (°F)	Ambient	Meter A	Meter B	Filter A	Filter B	Tunnel	FB Interior
0	0	1	0	0	0	1	1
100	100	101	100	100	100	101	101
300	300	300	300	300	300	301	301
500	500	500	500	500	500	501	501
700	700	700	700	700	700	701	701
1000	1000	1000	1000	1000	1000	1001	1001
1500	1500	1502	1500	1501	1500	1501	1501
2000	2000	2000	2001	2000	2001	2001	2001

Input (°F)	FB Top	FB Bottom	FB Back	FB Left	FB Right	Imp A	Imp B	Cat	Stack
0	1	1	1	1	1	0	0	0	1
100	101	101	101	101	101	100	100	100	101
300	301	301	301	301	301	300	300	300	301
500	501	501	501	501	501	500	500	500	501
700	701	701	701	701	701	700	700	700	701
1000	1001	1001	1001	1001	1001	1000	1000	1000	1001
1500	1501	1501	1501	1501	1501	1500	1500	1500	1501
2000	2001	2001	2001	2001	2001	2000	2000	2000	2001

Technician Signature: Tony Tong Date: 09/14/2023

Reviewed By: \_\_\_\_\_ Date: \_\_\_\_\_

# Certificate of Calibration

Certificate Number: 782459



**JJ Calibrations, Inc.**

7724 SE Aspen Summit Drive  
Portland, OR 97266-9217  
Phone 503.786.3005  
FAX 503.786.2994

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

PO: 220413  
Order Date: 11/04/2022  
Authorized By: N/A



Property #: OMNI-00430  
User: N/A  
Department: N/A  
Make: Delmhorst  
Model: MCS-1  
Serial #: OMNI 00430  
Description: Moisture Calibrator  
Procedure: Raw Data  
Accuracy: Raw Data

Calibrated on: 11/12/2022  
\*Recommended Due: 11/12/2023  
Environment: 23 °C 40 % RH  
\* As Received: Other - See Remarks  
\* As Returned: Other - See Remarks  
Action Taken: Calibrated  
Technician: 40

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.

Data is provided for your determination of acceptability.

### Standards Used

Std ID	Manufacturer	Model	Nomenclature	Due Date	Trace ID
582A	Fluke	8508A	8 1/2 Reference Mtr	06/28/2023	772664

Parameter	Measurement Description	Range Unit	Measurement Data				UUT	Uncertainty
			Reference	Min	Max	*Error		
<b>Before/After</b>							Accredited = ✓	
<b>Resistance</b>								
12 %		MOhm	120.0000	0.000	0.000	0.078	120.078 MOhm 5.7E-01 ✓	
22 %		MOhm	1.10000	0.0000	0.0000	0.0003	1.1003 MOhm 5.7E-01 ✓	

This instrument has been calibrated in accordance with the JJ Calibrations Quality Assurance Manual and is traceable to either the SI or to National Institute of Standards and Technology (NIST). The quality system and this certificate are in compliance with ANSI/NC SL Z540-1-1994, ISO/IEC 17025-2017, 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 stated in the comments, certificates reflect the "Simple Acceptance Rule" as specified by JCGM 106:2012. 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 written approval of JJ Calibrations.

Reviewer

3 Issued 11/15/2022

Rev # 15

Inspector



# QUALITY CONTROL SERVICES

LABORATORY EQUIPMENT • SALES • SERVICE • CALIBRATION • REPAIRS  
 2340 SE 11<sup>TH</sup> Ave. Portland, Oregon 97214 • Box 14831 Portland, Oregon 97293  
 (503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com



OMNI-Test Laboratories, Inc.  
 13327 NE Airport Way  
 Portland, OR 97230

Report Number: OMNE03MKW-04072230810

## A2LA ACCREDITED CERTIFICATE OF CALIBRATION WITH DATA

### INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Scale	EXCELL	MTW-150K	MKW-04072	OMNI-00353	Lab
Units	Readability	SOP	Cal Date	Last Cal Date	Cal Due Date
kg	0.05	QC033	8/10/23	N/A	8/2028

### FUNCTIONAL CHECKS

SHIFT TEST	LINEARITY	REPEATABILITY	ENVIRONMENTAL CONDITIONS
Test Wt: Tol: 50 0.20	Test Wt: Tol: HB44 HB44	Test Wt: Tol: 20 0.1	<input type="checkbox"/> Good <input checked="" type="checkbox"/> Fair <input type="checkbox"/> Poor  Temperature: 25.6°C
As-Found: Pass: <input checked="" type="checkbox"/> Fail: <input type="checkbox"/>	As-Found: Pass: <input checked="" type="checkbox"/> Fail: <input type="checkbox"/>	As-Found: Pass: <input checked="" type="checkbox"/> Fail: <input type="checkbox"/>	
As-Left: Pass: <input checked="" type="checkbox"/> Fail: <input type="checkbox"/>	As-Left: Pass: <input checked="" type="checkbox"/> Fail: <input type="checkbox"/>	As-Left: Pass: <input checked="" type="checkbox"/> Fail: <input type="checkbox"/>	

### CALIBRATION DATA

Standard	As-Found	As-Left	Expanded Uncertainty
150	150.05	150.05	0.029
100	100.05	100.05	0.029
50	50.00	50.00	0.029
25	25.00	25.00	0.029
10	10.00	10.00	0.029
5	5.00	5.00	0.029

### CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Avoirdupois Cast W	Rice Lake	25 and 50lb	PWO990-CA	7/18/22	7/2024	20221688
Avoirdupois Weight	Rice Lake	10lb to 0.001lb	95473	9/13/22	9/2023	20221504

Permanent Information Concerning this Equipment:

Comments/Information Concerning this Calibration

8/23 - Cleaned & leveled. Converted weight from lbs to kg. RH = 40%

Report prepared/reviewed by: RP Date: 8-14-23

Technician: D. Oudeans  
 Signature: R. Britton For D. Oudeans

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

The uncertainty is calculated according to the ISO Guide to the Expression of Uncertainty in Measurement and includes the uncertainty of standards used combined with the observed standard deviation of the unit under test. The uncertainty is expanded with a k factor of 2 for an approximate 95% level of confidence. 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.

Member: National Conference of Standards Laboratories and Weights & Measures

## Calibration Sheet For MTW-150K S/N MKW04072 (OMNI-00353)

Date : 11/30/2022

Verified by: Tony Tong

Reference Weights Used	Weight (lb)	Scale Readout					Compliance
		1	2	3	4	5	
00283B	2.2	2.2	2.2	2.2	2.2	2.2	✓
00283B	4.4	4.4	4.4	4.4	4.4	4.4	✓
00255	10	10.0	10.0	10.0	10.0	10.0	✓
00255, 00274	20	20.0	20.0	20.0	20.0	20.0	✓
00255, 00274, 00132	30	30.0	30.0	30.0	30.0	30.0	✓

## Equations and Sample Calculations – ASTM E2780 & E2515

Manufacturer: MF Fire  
Model: Nova C  
Run: 1  
Category:

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<sup>3</sup>

$M_{FTAdb}$  - 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



**M<sub>Sdb</sub> – Weight of test fuel spacers, dry basis, kg**

ASTM E2780 equation (1)

$$M_{Sdb} = (M_{Swb})(100/(100 + FM_S))$$

Where,

FM<sub>S</sub> = average fuel moisture of test fuel spacers, % dry basis

M<sub>Swb</sub> = weight of test fuel spacers, wet basis, kg

Sample Calculation:

$$FM_S = 10.4 \%$$

$$M_{Swb} = 1.7 \text{ lbs}$$

0.4536 = Conversion factor from lbs to kg

$$M_{Sdb} = [(1.7 \times 0.4536) (100/(100 + 10.4))]$$

$$M_{Sdb} = \mathbf{0.6983 \text{ kg}}$$

**$M_{Cdb}$** – Weight of test fuel crib, excluding nails and spacers, dry basis, kg  
ASTM E2780 equation (2)

$$M_{Cdb} = \Sigma[(M_{CPnwb})(100/(100 + FM_{CPn}))]$$

Where,

$M_{CPnwb}$  = weight of each test fuel piece n in fuel crib, excluding nails and spacers, wet basis, kg

$FM_{CPn}$  = Average fuel moisture of test fuel n in fuel crib, % dry basis

Sample Calculation (test fuel piece 1):

$$M_{CPnwb} = 11.0$$

$$FM_{CPn} = 20.5$$

$$= 11.0 (100/(100+ 20.5 )$$

$$= 9.1 \text{ lbs}$$

Total crib weight, excluding spacer 9.13 lbs

$$M_{Cdb} = \mathbf{4.14 \text{ kg}}$$

**$D_{Cdb}$**  - Density of fuel crib, excluding spacers and nails, dry basis, lbs/ft<sup>3</sup>  
ASTM E2780 equation (3)

$$D_{Cdb} = M_{Cdb}/V_C$$

Where,

$$V_C = \text{Volume of fuel crib, ft}^3$$

Sample calculation:

$$\begin{aligned} V_C &= 563.5 \text{ in}^3 \\ 1728 &= \text{conversion from in}^3 \text{ to ft}^3 \\ D_{Cdb} &= 9.13 / 563.5 * 1728 \\ &= \mathbf{27.9841} \text{ lbs/ft}^3 \end{aligned}$$

**M<sub>FTAdb</sub> - Total weight of fuel crib including spacers and nails, dry basis, kg**  
ASTM E2780 equation (4)

$$M_{FTAdb} = M_{Sdb} + M_{Cdb}$$

Sample calculation:

$$M_{FTAdb} = 0.698 + 4.14$$

$$= \mathbf{4.84 \text{ kg}}$$

Note: ASTM E2780 mistakenly calls this "Total weight of fuel crib **excluding** spacers and nails, dry basis, kg

**BR – dry burn rate, kg/hr**

ASTM E2780 equation (5)

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

Where,

$\theta$  = Total length of test run, min

Sample Calculation:

$$M_{Bdb} = 4.84 \quad \text{kg}$$

$$\theta = 141 \quad \text{min}$$

$$BR = \frac{60 \times 4.84}{141}$$

$$BR = \mathbf{2.06} \quad \text{kg/hr}$$

**V<sub>s</sub> – 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<sub>p</sub> = Adjustment factor for center of tunnel pitot tube placement,  $F_p = \frac{V_{strav}}{V_{scent}}$ , ASTM E2515 Equation (1)
- V<sub>scent</sub> = Dilution tunnel velocity calculated after the multi-point pitot traverse at the center, ft/sec
- V<sub>strav</sub> = Dilution tunnel velocity calculated after the multi-point pitot traverse, ft/sec
- k<sub>p</sub> = Pitot tube constant, 85.49
- C<sub>p</sub> = Pitot tube coefficient: 0.99, unitless
- ΔP\* = Velocity pressure in the dilution tunnel, in H<sub>2</sub>O
- T<sub>s</sub> = Absolute average gas temperature in the dilution tunnel, °R; (°R = °F + 460)
- P<sub>s</sub> = Absolute average gas static pressure in dilution tunnel, = P<sub>bar</sub> + P<sub>g</sub>, in Hg
- P<sub>bar</sub> = Barometric pressure at test site, in. Hg
- P<sub>g</sub> = Static pressure of tunnel, in. H<sub>2</sub>O; (in Hg = in H<sub>2</sub>O/13.6)
- M<sub>s</sub> = \*\*The dilution tunnel wet molecular weight; M<sub>s</sub> = 28.78 assuming a dry weight of 29 lb/lb-mole

Sample calculation:

$$F_p = \frac{21.68}{22.34} = 0.971$$

$$V_s = 0.971 \times 85.49 \times 0.99 \times 0.323 \times \left( \frac{128.4 + 460}{\left( 30.05 + \frac{-0.10}{13.6} \right) \times 28.78} \right)^{1/2}$$

$$V_s = \mathbf{21.87} \text{ ft/s}$$

\*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 M<sub>s</sub> as the dry molecular weight. It should be the wet molecular weight as indicated in EPA Method 2.

**Q<sub>sd</sub> – 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<sub>ws</sub> = Water vapor in gas stream, proportion by volume; assume 2%
- A = Cross sectional area of dilution tunnel, ft<sup>2</sup>
- T<sub>std</sub> = Standard absolute temperature, 528 °R
- P<sub>s</sub> = Absolute average gas static pressure in dilution tunnel, = P<sub>bar</sub> + P<sub>g</sub>, in Hg
- T<sub>s(avg)</sub> = Absolute average gas temperature in the dilution tunnel, °R; (°R = °F + 460)
- P<sub>std</sub> = Standard absolute pressure, 29.92 in Hg

Sample calculation:

$$Q_{sd} = 3600 \times (1 - 0.02) \times 21.87 \times 0.196 \times \frac{528}{128.4 + 460} \times \frac{30 + \frac{-0.10}{13.6}}{29.92}$$

$$Q_{sd} = \mathbf{13647.6} \text{ dscf/hr}$$

$V_{m(std)}$  – 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
- $\Delta H$  = Average pressure differential across the orifice meter, in. H<sub>2</sub>O
- $T_m$  = Absolute average dry gas meter temperature, °R

Sample Calculation:

Using equation for Train 1:

$$V_{m(std)} = 17.64 \times 22.785 \times 1.007 \times \frac{\left( 30.05 + \frac{1.25}{13.6} \right)}{\left( 91.6 + 460 \right)}$$

$$V_{m(std)} = \mathbf{22.115} \text{ dscf}$$

Using equation for Train 2:

$$V_{m(std)} = 17.64 \times 22.431 \times 1.015 \times \frac{\left( 30.05 + \frac{0.95}{13.6} \right)}{\left( 92.6 + 460 \right)}$$

$$V_{m(std)} = \mathbf{21.886} \text{ dscf}$$

Using equation for ambient train:

$$V_{m(std)} = 17.64 \times 22.02 \times 1.012 \times \frac{\left( 30.05 + \frac{0.00}{13.6} \right)}{\left( 83.2 + 460 \right)}$$

$$V_{m(std)} = \mathbf{21.746} \text{ dscf}$$



**$m_n$  – 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):

$$m_n = 0.0 + 0.0 + 0.0$$

$$m_n = 0.0 \text{ mg}$$

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

$$m_n = 0.0 + 5.1 + 0.9$$

$$m_n = 6.0 \text{ mg}$$

Train 1 aggregate:

$$m_n = 0.0 + 6.0$$

$$m_n = \mathbf{6.0} \text{ mg}$$

Using equation for Train 2:

$$m_n = 0 + 3.1 + 0.3$$

$$m_n = \mathbf{3.4} \text{ mg}$$

**C<sub>s</sub> - 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<sub>2</sub> = Constant, 0.001 g/mg
- m<sub>n</sub> = Total mass of particulate matter collected in the sampling train, mg
- V<sub>m(std)</sub> = Volume of gas sampled corrected to dry standard conditions, dscf

Sample calculation:

For Train 1:

$$C_s = 0.001 \times \frac{6.0}{22.12}$$

$$C_s = \mathbf{0.00027} \text{ g/dscf}$$

For Train 2

$$C_s = 0.001 \times \frac{3.4}{21.89}$$

$$C_s = \mathbf{0.00016} \text{ g/dscf}$$

For Ambient Train

$$C_r = 0.001 \times \frac{0.1}{21.75}$$

$$C_r = \mathbf{0.000005} \text{ g/dscf}$$

**$E_T$  – 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
- $\theta$  = Total time of test run, minutes

Sample calculation:

For Train 1

$$E_T = ( \underline{0.000271} - 0.000005 ) \times \underline{13647.6} \times \underline{141} /60$$
$$E_T = \underline{8.55} \text{ g}$$

For Train 2

$$E_T = ( \underline{0.000155} - 0.000005 ) \times \underline{13647.6} \times \underline{141} /60$$
$$E_T = \underline{4.83} \text{ g}$$

Average

$$E = \underline{6.69} \text{ g}$$

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

$$7.5\% \text{ of the average} = \underline{0.50}$$

$$\text{Train 1 difference} = \underline{1.86}$$

$$\text{Train 2 difference} = \underline{1.86}$$

**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:

- $\theta$  = Total sampling time, min
- $\theta_i$  = 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, °R
- $T_m$  = Absolute average dry gas meter temperature, °R
- $T_{si}$  = Absolute average gas temperature in the dilution tunnel during the "ith" time interval, °R
- $T_s$  = Absolute average gas temperature in the dilution tunnel, °R

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

$$PR = \left( \frac{141 \times 0.16 \times 21.87 \times (128.4 + 460) \times (91.6 + 460)}{1 \times 22.79 \times 22.92 \times (91.6 + 460) \times (84.0 + 460)} \right) \times 100$$

$$PR = \underline{102} \%$$

**PM<sub>R</sub> – Particulate emissions for test run, g/hr**

ASTM E2780 equation (6)

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

Where,

E<sub>T</sub> = Total particulate emissions, grams

θ = Total length of full integrated test run, min

Sample Calculation:

$$E_T (\text{Dual train average}) = 6.69 \text{ g}$$

$$\theta = 141 \text{ min}$$

$$PM_R = 60 \times ( 6.69 / 141 )$$

$$PM_R = \mathbf{2.85} \text{ g/hr}$$

**PM<sub>F</sub>** – Particulate emission factor for test run, g/dry kg of fuel burned  
ASTM E2780 equation (7)

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

Sample Calculation:

$$E_T \text{ (Dual train average)} = 6.69 \text{ g}$$

$$M_{Bdb} = 4.84 \text{ kg}$$

$$PM_F = 6.69 / 4.84$$

$$PM_F = \mathbf{1.38} \text{ g/kg}$$



OMB Control No. 2060-0161  
Approval expires 03/31/2019

OMB Control No. 2060-0693  
Approval expires 03/31/2019

EPA Form 6400-05

## RESIDENTIAL WOOD HEATER 30-DAY NOTIFICATION

### INSTRUCTIONS

**The manufacturer of an affected wood/pellet heater/central heater model line must notify the U.S. Environmental Protection Agency (EPA) of the date that certification testing is scheduled to begin. The EPA at least 30 days before the start of testing.**

This notification must be signed by a responsible representative of the manufacturer or an authorized representative. Once completed, this notification must be submitted to [WoodHeaterReports@epa.gov](mailto:WoodHeaterReports@epa.gov).

Affected residential wood-burning room heaters currently include, but are not limited to, adjustable burn rate stoves, catalytic adjustable burn rate stoves; hybrid adjustable burn rate stoves; single burn rate stoves; and pellet stoves. (40 CFR Part 60, Subpart AAA)

Affected residential wood-burning central heaters currently include, but are not limited to, indoor hydronic heaters (“wood boilers”); outdoor hydronic heaters (“outdoor wood boilers”); and forced-air furnaces (“warm air furnaces”). (40 CFR Part 60, Subpart QQQQ)

The public reporting and recordkeeping burden for this collection of information is estimated to average 8 hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Regulatory Support Division, U.S. Environmental Protection Agency (EPA) (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed application to this address.

Disclaimer: The statutory provisions and the EPA regulations described in this document contain legally binding requirements. This document is not a substitute for those provisions or regulations, nor is it a regulation itself. In the event of a discrepancy, please refer to Part 60 Subparts AAA AND QQQQ, Sections 60.537 and 60.5479. If you have additional questions, please contact Rafael Sanchez at 202-564-7028, Residential Wood Heater Compliance Program Lead, or via email at [sanchez.rafael@epa.gov](mailto:sanchez.rafael@epa.gov).

### MANUFACTURER INFORMATION

**Manufacturer's Name: MF FIRE, INC.**

**Manufacturer's Physical Address: 3031 Washington Boulevard, Suite G, Baltimore, MD 21230**

**Manufacturer's Mailing Address (if different from physical address):**

**Name and Title of Manufacturer's Responsible/Authorized Representative Submitting this Application: Ryan Fisher, Chief Operating Officer**

Manufacturer's Contact E-mail: [ryan@mffire.com](mailto:ryan@mffire.com)

Manufacturer's Phone Number: 240-285-4225

Manufacturer's Website Address: [www.mffire.com](http://www.mffire.com)

Manufacturer's Website Address where the test report and owner's manual will be posted, if known:  
[www.mffire.com](http://www.mffire.com)

### AFFECTED WOOD HEATER MODEL INFORMATION

Model Name(s) (as appearing on the certification test report). Please note: the model name and design number must clearly distinguish one model from another. The name and design number cannot include the EPA symbol or logo or name or derivatives such as "EPA": Nova C

Model Number(s) (as appearing on the certification test report, if applicable): 012

<b>Heater Type (Check one):</b>	<input type="checkbox"/> Adjustable Burn Rate Wood Heater	<input type="checkbox"/> Pellet Stove	<input checked="" type="checkbox"/> Single Burn Rate Heater	<input type="checkbox"/> Hydronic Heater	<input type="checkbox"/> Forced Air Furnace
<b>Hydronic Heater Type (Check one):</b>	<input type="checkbox"/> Full Storage	<input type="checkbox"/> Partial Storage	<input type="checkbox"/> No External Storage	<input type="checkbox"/> Indoor	<input type="checkbox"/> Outdoor
<b>Forced-Air Furnace Type (Check one):</b>	<input type="checkbox"/> Small (less than 65,000 BTU/hr heat output)		<input type="checkbox"/> Large (greater than 65,000 BTU/hr heat output)		
<b>Fuel Tested (Check one):</b>	<input checked="" type="checkbox"/> Crib	<input type="checkbox"/> Pellet	<input type="checkbox"/> Cordwood	<input type="checkbox"/> Wood Chips	<input type="checkbox"/> Other:
<b>Certification Step:</b>	<input type="checkbox"/> 2015	<input type="checkbox"/> 2016 (FAFs only)	<input type="checkbox"/> 2017 (FAFs only)	<input checked="" type="checkbox"/> 2020 (ALL HEATERS)	

Equipped with a catalytic combustor?  Yes  No

### EPA-APPROVED TEST LABORATORY

Name of EPA-Approved Test Laboratory: OMNI-Test Laboratories, Inc.

Name(s) of Person(s) Authorized and/or Responsible for Conducting Certification Test: Ken Morgan

Phone: 503-643-3788

E-mail: [kmorgan@omni-test.com](mailto:kmorgan@omni-test.com)

Fax: 503-643-3799

City: Portland

State: Oregon

ZIP Code: 97230

### EPA-APPROVED THIRD-PARTY CERTIFIER

Name of EPA-Approved Third-Party Certifier: OMNI-Test Laboratories, Inc.

Name(s) of Person(s) Authorized and/or Responsible for Reviewing Test Report and/or Issuing Certification of Conformity: Alex Tiegs

Phone: 503-643-3788

E-mail: [atiegs@omni-test.com](mailto:atiegs@omni-test.com)

Fax: 503-643-3799

City: Portland

State: Oregon

ZIP Code: 97230



## COMPLIANCE TEST INFORMATION

Test Method(s): EPA Method 28R, ASTM E2780

Date(s) of Proposed Test: July 11, 2023 – July 14, 2023

Testing Location (Name and Address): OMNI-Test Laboratories, Inc.  
13327 NE Airport Way, Portland, Oregon, 97230

Technician's Contact Name: Ken Morgan, Riley Tiegs

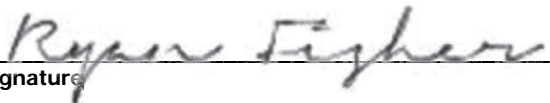
Title: Technical Services Director

Phone Number: 503-643-3788

Email Address: [kmorgan@omni-test.com](mailto:kmorgan@omni-test.com), [rtiegs@omni-test.com](mailto:rriegs@omni-test.com)

Ryan Fisher, Chief Operating Officer

Print Name and Title of Authorized Official



Signature

6/11/2023

Date

Telephone Number: 2402854225

Email Address: [ryan@mffire.com](mailto:ryan@mffire.com)

Remarks:

v1

## OMNI-Test Laboratories Quality Assurance / Quality Control Statement

*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:

- 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 facility and quality control system for the production of the Nova C at MF Fire was evaluated and it was determined to comply with *OMNI*'s processes and quality control procedures.

This report shall not be reproduced, except in full, without the written approval of *OMNI-Test Laboratories, Inc.*

## **8. APPENDICIES**

## **Appendix A**

### Uncorrected Filter Data and Results

## Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer: MF Fire \_\_\_\_\_ Equipment Numbers: \_\_\_\_\_  
 Model: Nova C \_\_\_\_\_  
 Tracking No.: 2468 \_\_\_\_\_  
 Project No.: 0552WS003E \_\_\_\_\_  
 Run #: 1 \_\_\_\_\_  
 Date: 7/11/23 \_\_\_\_\_

UNCORRECTED

**First Hour**

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

**TRAIN 1**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	E985	123.5	118.3	5.2
C. Rear filter catch	Filter	E986	118.2	118.3	0.0
D. Probe catch*	Probe	13	114321.5	114321.5	0.0
E. Filter seals catch*	Seals	S526	3320.1	3320.1	0.0

**Sub-Total**    **Total Particulate, mg:**    **5.2**

**Train 1 Aggregate**    **Total Particulate, mg:**    **5.2**

**TRAIN 2**

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	E987	122.8	117.9	4.9
B. Rear filter catch	Filter	E988	116.3	118.1	0.0
C. Probe catch*	Probe	35	114327.4	114327.4	0.0
D. Filter seals catch*	Seals	S527	3269.4	3269.1	0.3

**Total Particulate, mg:**    **5.2**

**AMBIENT**

Sample Component	Reagent	Filter # or Probe #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch*	Filter	E989	117.8	117.7	0.1

**Total Particulate, mg:**    **0.1**

\*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: MF Fire  
 Model: Nova C  
 Project No.: 0552WS003E  
 Tracking No.: 2468  
 Run: 1  
 Test Date: 07/11/23

Technician Signature: \_\_\_\_\_

Burn Rate	<b>2.06 kg/hr dry</b>
Average Tunnel Temperature	128 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	21.87 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	13647.6 dscf/hour
Average Delta p	0.104 inches H2O
Total Time of Test	141 minutes

UNCORRECTED

	AMBIENT		SAMPLE TRAIN 1		SAMPLE TRAIN 2		FIRST HOUR FILTER (TRAIN 1)	
	Requirement	Measured / Observed	Requirement	Measured / Observed	Requirement	Measured / Observed	Requirement	Measured / Observed
Total Sample Volume - Vm	22.024 cubic feet		22.785 cubic feet		22.431 cubic feet		9.605 cubic feet	
Average Gas Meter Temperature	83 degrees Fahrenheit		92 degrees Fahrenheit		93 degrees Fahrenheit		88 degrees Fahrenheit	
Total Sample Volume (Standard Conditions) - Vmst	21.746 dscf		22.115 dscf		21.886 dscf		9.375 dscf	
Total Particulates - m <sub>p</sub>	0.1 mg		5.2 mg		5.2 mg		0 mg	
Particulate Concentration (dry-standard) - C <sub>p</sub> /C <sub>s</sub>	0.000005 grams/dscf		0.00024 grams/dscf		0.00024 grams/dscf		0.00000 grams/dscf	
Total Particulate Emissions - E <sub>T</sub>	0.15 grams		7.39 grams		7.47 grams		0.00 grams	
Particulate Emission Rate	0.06 grams/hour		3.15 grams/hour		3.18 grams/hour		0.00 grams/hour	
Emissions Factor			1.53 g/kg		1.55 g/kg		0.00 g/kg	
Difference from Average Total Particulate Emissions			0.04 grams		0.04 grams		0.001 grams	
<b>Final Average Results</b>								
<b>Complete Test Run</b>								
Total Particulate Emissions - E <sub>T</sub>	7.43 grams		Filter Temps, °F	< 90	86	Train 1	88	Complies?
Particulate Emission Rate	<b>3.16 grams/hour</b>		Filter Face Velocity, fpm	< 30	8.73	8.78	8.78	OK
Emissions Factor	1.54 grams/kg		Dryer Exit Temp, °F	< 80	60	60	49	OK
			Leakage Rate, cfm	0.01	0.000	0.001	0.001	OK
			< 4% of avg sample rate or					
			< 0.01 cfm, lesser of the two					
<b>First Hour Emissions</b>			Neg. Probe Weight	=> 0	0	0	0	OK
Total Particulate Emissions - E <sub>T</sub>	0.00 grams				0.00%	0.00%	0.00%	OK
Particulate Emission Rate	0.00 grams/hour		Pro-Rate Variation	< 90 for < 10% of θ	0.00%	0.00%	0.00%	OK
Emissions Factor	0.00 grams/kg			> 110 for < 10% of θ	0.00%	0.00%	0.00%	OK
				# Readings > 80%	0	0	0	OK
				# Readings > 120%	0	0	0	OK
7.5% of Average Total Particulate Emissions	0.56 grams		Ambient Temp, °F (min / max)	< 55	81	81	81	OK
				> 90	85	85	85	OK
			Train Precision	(A) Within 7.5%	0.5%	0.5%	0.5%	OK
			One of A or B must	(B) Within 0.5 g/kg	0.02	0.02	0.02	OK
			Stove Surface ΔT	Within 125 °F	52	52	52	OK
			Room Air Velocity	< 50 fpm	16	16	16	OK

## **Appendix B**

Correspondence regarding catalyst temperature monitoring provision



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## MF Fire Nova Application for U.S. EPA Wood Heater Certification

33 messages

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**Ryan Fisher** <ryan@mfire.com>

To: WoodHeaterReports@epa.gov

Cc: aldridge.amanda@epa.gov, "Sanchez, Rafael" <Sanchez.Rafael@epa.gov>, Paul LaPorte <paul@mfire.com>, Information <info@mfire.com>, Kelli O'Brien <kelli@clearstak.com>

Thu, May 3, 2018 at 12:26 PM

To whom it may concern,

Attached please find our application for U.S. EPA Wood Heater Certification for MF Fire's second wood stove, Nova as well as a packet titled "Model Nova EPA Report (CBI) which includes:

- Certification test report prepared by an EPA-approved test laboratory, Clearstak LLC
- Certification of conformity by an EPA-approved third-party certifier, UL LLC
- Quality assurance plan
- Additional required supporting information.

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### Two additional comments:

- When requesting the ISO certificates from the third party certifier, UL LLC, the response provided to MF Fire from UL LLC was "We had to provide those Cert. copies at the time we received the Third Party Accreditation. EPA has those Certs on File. We do not need to provide those again."
- MF Fire filled out the application to the best of our understanding. MF Fire was slightly unclear on what the EPA is looking for in the required manufacturer statements in sections 2, 4, 7, and 8. The requirements of sections 2, 4, 7, and 8 are clear, but please inform MF Fire if the form was not filled out as intended by the EPA.

Thank you for your consideration,

Ryan Fisher  
COO, MF Fire  
Ryan@MFFire.com  
Direct Cell: 240-285-4225  
Main Office: 1-855-MFFire1



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**2 attachments**



 **EPA NSPS Affected Source Application Form\_MF Fire Nova 050318.pdf**  
500K

 **Model Nova EPA Report (CBI).pdf**  
4680K

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**Ryan Fisher** <[ryan@mffire.com](mailto:ryan@mffire.com)>

To: WoodHeaterReports@epa.gov

Cc: Amanda Aldridge <[aldridge.amanda@epa.gov](mailto:aldridge.amanda@epa.gov)>, "Sanchez, Rafael" <[Sanchez.Rafael@epa.gov](mailto:Sanchez.Rafael@epa.gov)>, Paul LaPorte <[paul@mffire.com](mailto:paul@mffire.com)>, Information <[info@mffire.com](mailto:info@mffire.com)>, Kelli O'Brien <[kelli@clearstak.com](mailto:kelli@clearstak.com)>

Mon, Aug 20, 2018 at 3:02 PM

To whom it may concern,

I am emailing to receive an update on this submission. If you could please provide an update on when the decision/approval can be expected, it would much appreciated.

Best regards,

Ryan Fisher  
COO, MF Fire

[Ryan@MFFire.com](mailto:Ryan@MFFire.com)

Direct Cell: 240-285-4225

Main Office: 1-855-MFFire1

289



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---

**Sanchez, Rafael** <[Sanchez.Rafael@epa.gov](mailto:Sanchez.Rafael@epa.gov)>

To: Ryan Fisher <[ryan@mffire.com](mailto:ryan@mffire.com)>

Cc: "Aldridge, Amanda" <[Aldridge.Amanda@epa.gov](mailto:Aldridge.Amanda@epa.gov)>, Paul LaPorte <[paul@mffire.com](mailto:paul@mffire.com)>, Information <[info@mffire.com](mailto:info@mffire.com)>, Kelli O'Brien <[kelli@clearstak.com](mailto:kelli@clearstak.com)>

Mon, Aug 20, 2018 at 3:16 PM

Hi Ryan,

Thank you for contacting the U. S. Environmental Protection Agency (EPA). I am currently working on your certification request. It should take a few weeks to get it through our management chain and get you a certification determination.

**Rafael Sanchez, Ph.D.**

**Wood Heater Program Lead**

Air Branch  
Monitoring, Assistance, and Media Programs Division  
Office of Compliance  
U.S. Environmental Protection Agency (EPA)

Room 7149-D  
1200 Pennsylvania Ave., NW  
MS:2227A  
Washington, DC 20460  
202-564-7028  
202-564-0050 fax

Please make a note of the new inbox for wood heater certification requests: [WoodHeaterReports@epa.gov](mailto:WoodHeaterReports@epa.gov)

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If you have a wood heater question, please visit the USEPA Wood Heater Compliance Monitoring Program website at <http://www2.epa.gov/compliance/wood-heater-compliance-monitoring-program>. On that web page, you will find information about the EPA wood heater compliance program including the List of EPA Certified Wood Heaters.

This message may contain sensitive and/or privileged information. If you believe you have received this e-mail in error, please notify me and delete the e-mail immediately.

[Quoted text hidden]

---

**Ryan Fisher** <[ryan@mffire.com](mailto:ryan@mffire.com)>  
To: "Sanchez, Rafael" <[Sanchez.Rafael@epa.gov](mailto:Sanchez.Rafael@epa.gov)>  
Cc: "Aldridge, Amanda" <[Aldridge.Amanda@epa.gov](mailto:Aldridge.Amanda@epa.gov)>, Paul LaPorte <[paul@mffire.com](mailto:paul@mffire.com)>, Kelli O'Brien <[kelli@clearstak.com](mailto:kelli@clearstak.com)>

Mon, Aug 20, 2018 at 3:18 PM

Hi Rafael,

Thank you very much for the quick response and update. Have a great day.

Best regards,

Ryan Fisher  
COO, MF Fire  
[Ryan@MFFire.com](mailto:Ryan@MFFire.com)

Direct Cell: 240-285-4225  
Main Office: 1-855-MFFire1



[Quoted text hidden]

**Sanchez, Rafael** <Sanchez.Rafael@epa.gov>  
To: Ryan Fisher <ryan@mffire.com>

Cc: "Aldridge, Amanda" <Aldridge.Amanda@epa.gov>, Paul LaPorte <paul@mffire.com>, Information <info@mffire.com>, Kelli O'Brien <kelli@clearstak.com>

Mon, Aug 20, 2018 at 3:49 PM

Hi Ryan,

I did a quick review for completeness on your test report. Below are some findings or deficiencies:

1. Table 5 Emissions Summary B: CO value should be presented in g/min. Please covert units to the specified units.
2. There is no narration or description of test runs. Please address.

(5) All documentation pertaining to a valid certification test, including the complete test report and, for all test runs: Raw data sheets, laboratory technician notes, calculations and test results. Documentation must include the items specified in the applicable test methods. Documentation must include discussion of each test run and its appropriateness and validity, and must include detailed discussion of all anomalies, whether all burn rate

categories were achieved, any data not used in the calculations and, for any test runs not completed, the data collected during the test run and the reason(s) that the test run was not completed and why. The burn rate for the low burn rate category must be no greater than the rate that an operator can achieve in home use and no greater than is advertised by the manufacturer or retailer. The test report must include a summary table that clearly presents the individual and overall emission rates, efficiencies and heat outputs.

**3. No owner's manual. Please submit one.**

**4. Test report doesn't mention the application of the 3/6/18 alternative test method. The Operation Procedures section should note that ATM was used.**

**5. The CBI test report should be sent separately via US Mail or dropbox (not email) and not combined with the non-CBI test report.**

**6. There is no data for run #2 nor narration. Please provide data.**

**Please address above-referenced deficiencies and resubmit test reports by 8/24/18. If you have further questions, please let me know.**

**Rafael Sanchez, Ph.D.**

**Wood Heater Program Lead**

**Air Branch**

**Monitoring, Assistance, and Media Programs Division**

**Office of Compliance**

**U.S. Environmental Protection Agency (EPA)**

**Room 7149-D**

**1200 Pennsylvania Ave., NW**

**MS:2227A**

**Washington, DC 20460**

**202-564-7028**

**202-564-0050 fax**

**Please make a note of the new inbox for wood heater certification requests: [WoodHeaterReports@epa.gov](mailto:WoodHeaterReports@epa.gov)**

**If you have a wood heater question, please visit the USEPA Wood Heater Compliance Monitoring Program website at <http://www2.epa.gov/compliance/wood-heater-compliance-monitoring-program>. On that web page, you will find information about the EPA wood heater compliance program including the List of EPA Certified Wood Heaters.**

2/3

This message may contain sensitive and/or privileged information. If you believe you have received this e-mail in error, please notify me and delete the e-mail immediately.

**From:** Ryan Fisher [<mailto:ryan@mffire.com>]

**Sent:** Thursday, May 03, 2018 12:26 PM

**To:** WoodHeaterReports <[WoodHeaterReports@epa.gov](mailto:WoodHeaterReports@epa.gov)>

**Cc:** Aldridge, Amanda <[Aldridge.Amanda@epa.gov](mailto:Aldridge.Amanda@epa.gov)>; Sanchez, Rafael <[Sanchez.Rafael@epa.gov](mailto:Sanchez.Rafael@epa.gov)>; Paul LaPorte <[paul@mffire.com](mailto:paul@mffire.com)>; Information <[info@mffire.com](mailto:info@mffire.com)>; Kelli O'Brien <[kelli@clearstak.com](mailto:kelli@clearstak.com)>

[Quoted text hidden]

[Quoted text hidden]

---

**Ryan Fisher** <[ryan@mffire.com](mailto:ryan@mffire.com)>

To: "Sanchez, Rafael" <[Sanchez.Rafael@epa.gov](mailto:Sanchez.Rafael@epa.gov)>

Cc: "Aldridge, Amanda" <[Aldridge.Amanda@epa.gov](mailto:Aldridge.Amanda@epa.gov)>, Paul LaPorte <[paul@mffire.com](mailto:paul@mffire.com)>, Kelli O'Brien <[kelli@clearstak.com](mailto:kelli@clearstak.com)>

Mon, Aug 20, 2018 at 3:56 PM

Rafael,

Thank you for this notice. We will be addressing these items immediately.

Best regards,

[Quoted text hidden]

Tue, Aug 21, 2018 at 1:54 PM

**Ryan Fisher** <[ryan@mffire.com](mailto:ryan@mffire.com)>  
To: "Sanchez, Rafael" <[Sanchez.Rafael@epa.gov](mailto:Sanchez.Rafael@epa.gov)>  
Cc: Kelli O'Brien <[kelli@clearstak.com](mailto:kelli@clearstak.com)>, "Aldridge, Amanda" <[Aldridge.Amanda@epa.gov](mailto:Aldridge.Amanda@epa.gov)>, Paul LaPorte <[paul@mffire.com](mailto:paul@mffire.com)>

Hi Rafael,

The Owner's Manual is attached. Would you like this in the report or does this email attachment suffice? Should the CBI report be mailed to the address in your email signature?

Thank you,

**Ryan Fisher**  
COO, MF Fire  
[Ryan@MFFire.com](mailto:Ryan@MFFire.com)  
Direct Cell: 240-285-4225  
Main Office: 1-855-MFFire1



294

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 **Nova Owners Manual.pdf**  
549K

Tue, Aug 21, 2018 at 2:02 PM

**Kelli O'Brien** <[kelli@clearstak.com](mailto:kelli@clearstak.com)>  
To: "Sanchez, Rafael" <[Sanchez.Rafael@epa.gov](mailto:Sanchez.Rafael@epa.gov)>, Ryan Fisher <[ryan@mffire.com](mailto:ryan@mffire.com)>  
Cc: "Aldridge, Amanda" <[Aldridge.Amanda@epa.gov](mailto:Aldridge.Amanda@epa.gov)>, Paul LaPorte <[paul@mffire.com](mailto:paul@mffire.com)>, Information <[info@mffire.com](mailto:info@mffire.com)>

Rafael - Sorry, I am not sure how that happened. Non-CBI report (only) attached with page 14 included.

[Quoted text hidden]

 **CSL-00010\_FRM-000021 Lab ReportV3 NON-CBI.pdf**  
13052K

Tue, Aug 21, 2018 at 2:24 PM

**Ryan Fisher** <[ryan@mffire.com](mailto:ryan@mffire.com)>  
To: "Sanchez, Rafael" <[Sanchez.Rafael@epa.gov](mailto:Sanchez.Rafael@epa.gov)>


**Ryan Fisher**  
COO, MF Fire

Ryan@MFFire.com  
Direct Cell: 240-285-4225  
Main Office: 1-855-MFFire1



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 **CSL-00010\_FRM-000021 Lab ReportV3 NON-CBI.pdf**  
13052K

Tue, Aug 21, 2018 at 2:24 PM

**Ryan Fisher** <ryan@mffire.com>  
To: "Sanchez, Rafael" <Sanchez.Rafael@epa.gov>


Ryan Fisher  
COO, MF Fire  
Ryan@MFFire.com  
Direct Cell: 240-285-4225  
Main Office: 1-855-MFFire1



----- Forwarded message -----  
From: **Kelli O'Brien** <kelli@clearstak.com>  
Date: Tue, Aug 21, 2018 at 2:02 PM

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 **CSL-00010\_FRM-000021 Lab ReportV3 NON-CBI.pdf**  
13052K

Tue, Aug 21, 2018 at 2:46 PM

**Sanchez, Rafael** <Sanchez.Rafael@epa.gov>  
To: Kelli O'Brien <kelli@clearstak.com>, Ryan Fisher <ryan@mffire.com>  
Cc: "Aldridge, Amanda" <Aldridge.Amanda@epa.gov>, Paul LaPorte <paul@mffire.com>, Information <info@mffire.com>

Hi Ryan,

Per our conversation, below are additional deficiencies that I identified after submission of the owner's manual.

1. **The test report should include an engineering diagram showing the location of the temperature sensor.** Per WH rule: (h) Temperature sensor requirement.

An affected wood heater equipped with a catalytic combustor must be equipped with a temperature sensor that can monitor combustor gas stream temperatures within or immediately downstream [within 2.54 centimeters. 60.532.

2. Owner's manual should have the following statements for catalytic equipped heaters: 60.536

“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.”

### 3. *Smoke and Carbon Monoxide*

*Emissions and Monitors* Owner's manual must include:

- (a) Discussion of smoke and carbon monoxide (CO) emissions, including the CO data submitted in the certification application and expected variations for different operating conditions;



- (b) Recommendation to have smoke monitors; and
- (c) Recommendation to have monitors for areas that are expected to generate CO, *e.g.*, heater fueling areas, pellet fuel bulk storage areas, sheds containing hydronic heaters. **Appendix I to Part 60 (page 13753)**

For your convenience, I have attached a copy of the regulations. Please submit the above information by 8/24/18. If you have further questions, please let me know.

(1 inch)]**Rafael Sanchez, Ph.D.**

**Wood Heater Program Lead**

**Air Branch**

**Monitoring, Assistance, and Media Programs Division**

**Office of Compliance**

**U.S. Environmental Protection Agency (EPA)**

**Room 7149-D**

**1200 Pennsylvania Ave., NW**

**MS:2227A**

**Washington, DC 20460**

**202-564-7028**

**202-564-0050 fax**

**Please make a note of the new inbox for wood heater certification requests: [WoodHeaterReports@epa.gov](mailto:WoodHeaterReports@epa.gov)**

**If you have a wood heater question, please visit the USEPA Wood Heater Compliance Monitoring Program website at <http://www2.epa.gov/compliance/wood-heater-compliance-monitoring-program>. On that web page, you will find information about the EPA wood heater compliance program including the List of EPA Certified Wood Heaters.**

This message may contain sensitive and/or privileged information. If you believe you have received this e-mail in error, please notify me and delete the e-mail immediately.

**From:** Kelli O'Brien [mailto:kelli@clearstak.com]  
**Sent:** Tuesday, August 21, 2018 12:05 PM

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 **WH rule.pdf**  
2496K

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**Kelli O'Brien** <kelli@clearstak.com>  
To: Ryan Fisher <Ryan@mffire.com>

Tue, Aug 21, 2018 at 2:59 PM

Since this is an engineering drawing I can merge it into Appendix A of the CBI copy. Just send me the drawing when you figure things out on your end.

[Quoted text hidden]

 **WH rule.pdf**  
2496K

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**Ryan Fisher** <ryan@mffire.com>  
To: Paul LaPorte <paul@mffire.com>

Thu, Aug 23, 2018 at 3:23 PM

Hi Rafael,

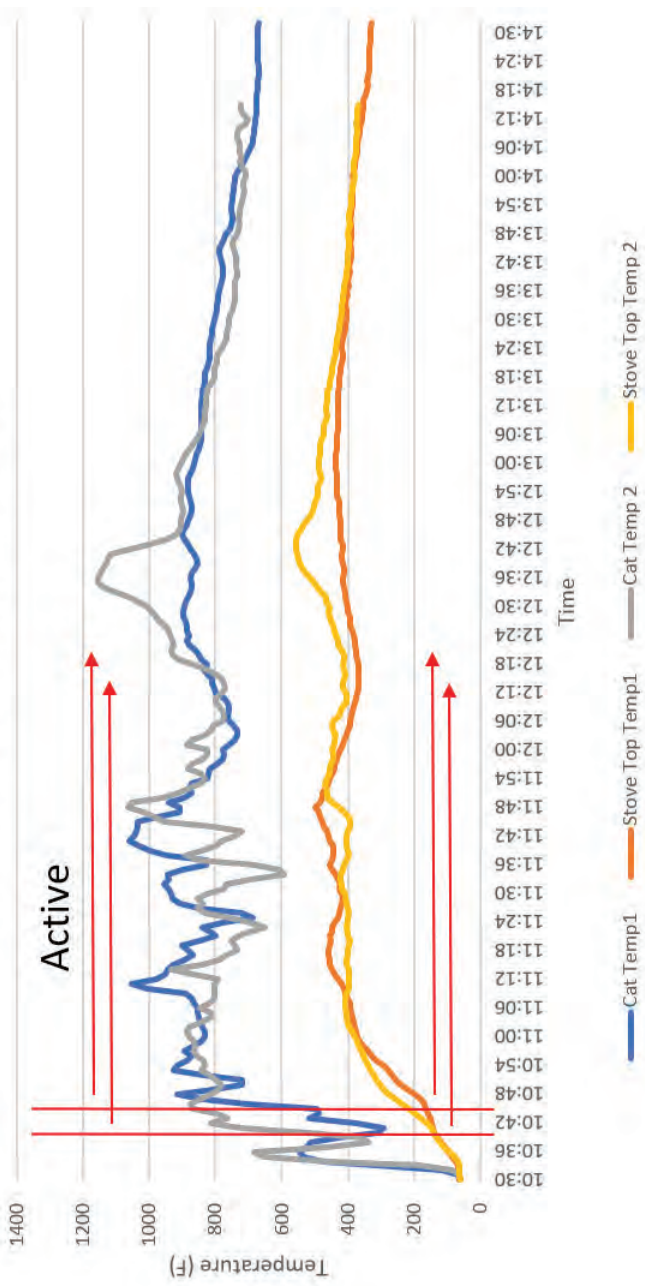
Per our discussion this week, we would like to use a magnetic thermometer placed on top of the stove (Nova) within 1" of the exhaust of the catalytic combustor. The stove top temperature provides a reliable reference to post-catalytic combustor temperature regarding when a user should engage the bypass. Engaging the catalytic combustor via the bypass is recommended at or above 500 F. As you can see from the temperature graphs below from our EPA testing (below and attached), this is reliably seen when the stove top temperature above the catalytic exhaust reaches 200 F. The magnetic thermometer proposed for the stove top of Nova would read "Active" when the stove top thermometer reaches 200 F and above. This, combined with Owner's Manual instruction on using the thermometer and bypass, allows simple instruction to the user on when to engage the catalytic combustor via the bypass.

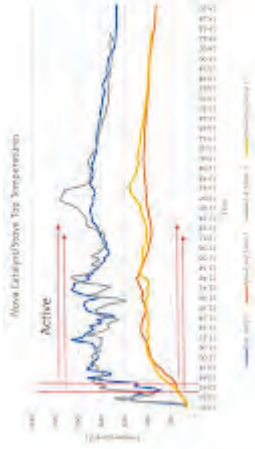
We see precedent in the market in at least one instance: the Woodstock Soapstone Absolute Steel Hybrid 211 which is certified for 2020. According to the Owner's Manual for this stove, a *stove pipe* thermometer is used to tell the user when to engage the catalytic combustor. We believe our stove top thermometer located within 1" of catalytic combustor exhaust is just as, if not more, effective than a stove pipe thermometer for informing the user on when to engage the catalytic combustor.

I have attached an edit to our engineering drawings detailing this placement.

Please see the pictures below and attached and let me know if you have any questions. We look forward to getting this wrapped up as soon as possible.

# Nova Catalyst/Stove Top Temperatures





Post Cat, Stove Top Temperatures (NOVA).JPG  
82K

 [Magnetic Thermometer.html](#)  
2532K

Thu, Aug 23, 2018 at 4:14 PM

**Ryan Fisher** <[ryan@mfire.com](mailto:ryan@mfire.com)>  
To: "Sanchez, Rafael" <[Sanchez.Rafael@epa.gov](mailto:Sanchez.Rafael@epa.gov)>  
Cc: "Aldridge, Amanda" <[Aldridge.Amanda@epa.gov](mailto:Aldridge.Amanda@epa.gov)>, Paul LaPorte <[paul@mfire.com](mailto:paul@mfire.com)>

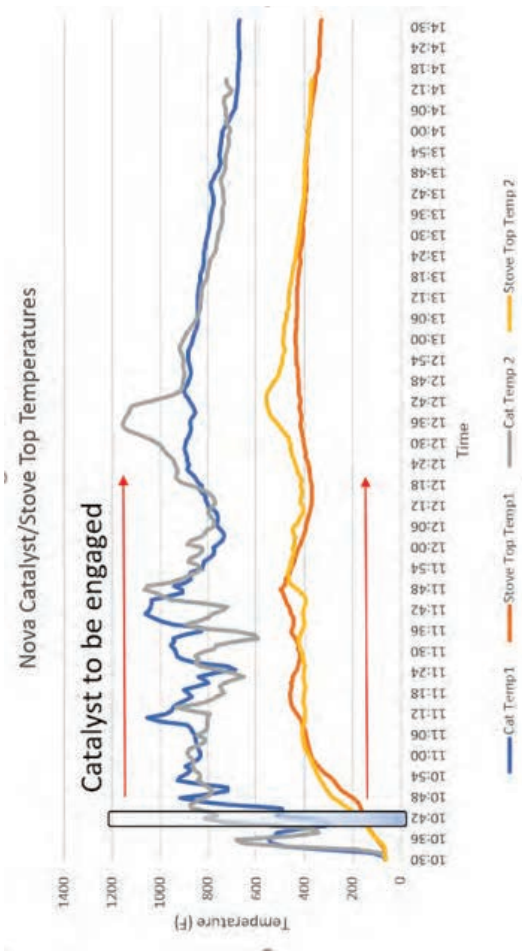
Hi Rafael,

Per our discussion this week, we would like to use a magnetic thermometer placed on top of the stove (Nova) within 1" of the exhaust of the catalytic combustor. The stove top temperature provides a reliable reference to post-catalytic combustor temperature regarding when a user should engage the bypass. Engaging the catalytic combustor via the bypass is recommended at or above 500 F in the exhaust near the catalytic combustor. As you can see from the temperature graphs below from our EPA testing (below and attached), this is reliably seen when the stove top temperature above the catalytic combustor exhaust area reaches 200 F. The blue shaded rectangle on the graph encompasses the area on both tests where the 500 F post-catalytic combustor temperature is met. The magnetic thermometer proposed for the stove top of Nova would read "Active" when the stove top thermometer reaches 200 F and above. An example picture of this style thermometer is attached. This, combined with Owner's Manual instruction on using the thermometer and bypass, allows simple instruction to the user on when to engage the catalytic combustor via the bypass.

We see precedent in the market in at least one instance: the Woodstock Soapstone Absolute Steel Hybrid 211 which is certified for 2020. According to the Owner's Manual for this stove, a *stove pipe* thermometer is used to tell the user when to engage the catalytic combustor. We believe our stove top thermometer located within 1" of catalytic combustor exhaust is just as, if not more, effective than a stove pipe thermometer for informing the user on when to engage the catalytic combustor.

I have attached an edit to our engineering drawings detailing this placement. The edit can be seen on the Nova-01 drawing in the top left view. The location of the thermometer is 1" from the catalytic combustor effluent in the horizontal plane, and less than 1" from the catalytic combustor in the vertical plane.

Please see the pictures below and attached and let me know if you have any questions. We look forward to getting this wrapped up as soon as possible. Best regards,

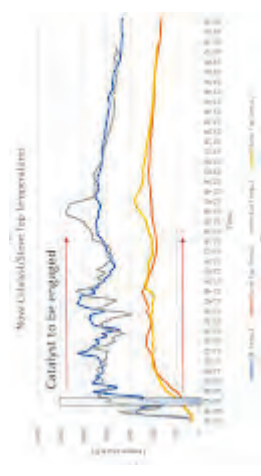


Ryan Fisher  
 COO, MF Fire  
 Ryan@MFFire.com  
 Direct Cell: 240-285-4225  
 Main Office: 1-855-MFFire1



On Tue, Aug 21, 2018 at 2:46 PM, Sanchez, Rafael <Sanchez.Rafael@epa.gov> wrote:  
 [Quoted text hidden]

**3 attachments**



**Post Cat, Stove Top Temperatures (NOVA).JPG**  
 83K

**Magnetic Thermometer.html**  
 2532K

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**Sanchez, Rafael** <Sanchez.Rafael@epa.gov>

To: Ryan Fisher <ryan@mffire.com>

Cc: "Aldridge, Amanda" <Aldridge.Amanda@epa.gov>, Paul LaPorte <paul@mffire.com>, "Toney, Mike" <Toney.Mike@epa.gov>

Fri, Aug 24, 2018 at 10:35 AM

Hi Ryan,

I had one of my colleague, Mike Toney, review the eng diagrams and other information. To continue our review, we need to know where the temp sensor is in relation to the cat combustor as shown in plain view cc (from the back of the stove in inches.) Please submit by 8/28/18.

Ryan, I noticed you mentioned the Woodstock hybrid heater and its owner's manual. Is that OM from a recent model or one that was manufactured back in 2015?

[Quoted text hidden]

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**Ryan Fisher** <ryan@mffire.com>

To: "Sanchez, Rafael" <Sanchez.Rafael@epa.gov>

Cc: "Aldridge, Amanda" <Aldridge.Amanda@epa.gov>, Paul LaPorte <paul@mffire.com>, "Toney, Mike" <Toney.Mike@epa.gov>

Fri, Aug 24, 2018 at 2:16 PM

Hi Rafael,

I have attached an updated drawing that details the distance I believe you are requesting. I think you are requesting the distance form the magnetic thermometer to the top of the catalytic combustor. That distance is 13/16" and I had it added to the bottom-right drawing in the attached drawing. I had this shown from a side cut view because I thought it would be most clear. Please check it out and let me know if you need an additional dimension specified.

Regarding the Woodstock Soapstone model I referred to, I am referring to the documentation on their website which shows a test date of Jan 5 - 14 2016 with a report date of February 2016.

Best,

Ryan Fisher

COO, MF Fire

Ryan@MFFire.com

Direct Cell: 240-285-4225

Main Office: 1-855-MFFire1



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 **Nova-01\_082418.pdf**  
443K

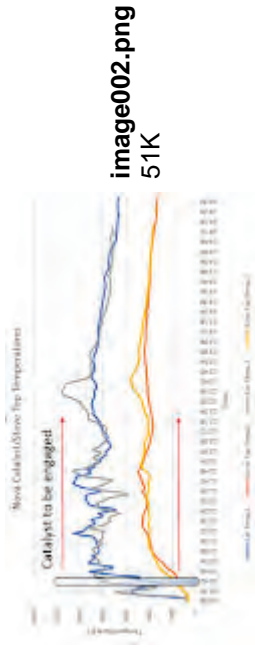
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**Ryan Fisher** <ryan@mfire.com>  
To: ryanmfire@outlook.com

Sat, Aug 25, 2018 at 8:59 PM

----- Forwarded message -----  
From: **Ryan Fisher** <ryan@mfire.com>  
[Quoted text hidden]  
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**2 attachments**



 **Nova-01\_082418.pdf**  
443K

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**Ryan Fisher** <ryan@mfire.com>  
To: "Sanchez, Rafael" <Sanchez.Rafael@epa.gov>  
Cc: Amanda Aldridge <aldridge.amanda@epa.gov>, Paul LaPorte <paul@mfire.com>, "Toney, Mike" <Toney.Mike@epa.gov>

Tue, Aug 28, 2018 at 8:55 PM

Hi Rafael,

I hope all is well. I wanted to follow up and see if this was the information you were requesting and if there was any additional information we could provide for your review.

Thank you,  
Ryan Fisher  
[Quoted text hidden]

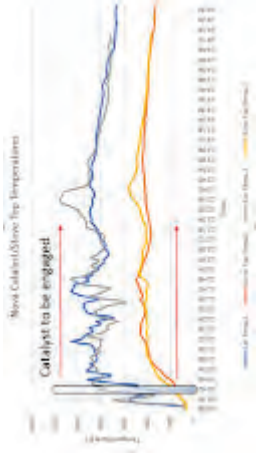


image002.png  
51K

Wed, Aug 29, 2018 at 3:26 PM

**Sanchez, Rafael** <Sanchez.Rafael@epa.gov>  
To: Ryan Fisher <ryan@mfire.com>  
Cc: "Aldridge, Amanda" <Aldridge.Amanda@epa.gov>, Paul LaPorte <paul@mfire.com>, "Toney, Mike" <Toney.Mike@epa.gov>

Hi Ryan,

I tried to leave a message but it seems that you are out of the country. I wanted to follow up on the owner's manual and whether you were able to add the required regulatory text.

34

I will need to get an updated copy of the OM to continue with my review. Thanks.

[Quoted text hidden]

Thu, Aug 30, 2018 at 9:27 AM

**Ryan Fisher** <ryan@mfire.com>  
To: "Sanchez, Rafael" <Sanchez.Rafael@epa.gov>  
Cc: Amanda Aldridge <aldridge.amanda@epa.gov>, Paul LaPorte <paul@mfire.com>, "Toney, Mike" <Toney.Mike@epa.gov>

Hi Rafael,

Thanks for the email. I have attached our updated Owner's Manual for this product. The required language around catalytic combustor, smoke and carbon monoxide detectors is on page 4. The average carbon monoxide test result is listed on page 6.

Please let me know if you require any additional information. I am out of the country and on a different time schedule, so email is likely easiest - thank you.

Best regards,  
Ryan Fisher  
[Quoted text hidden]



**Ryan Fisher** <ryan@mfire.com>

To: "Sanchez, Rafael" <Sanchez.Rafael@epa.gov>

Cc: Amanda Aldridge <aldridge.amanda@epa.gov>, Paul LaPorte <paul@mfire.com>, "Toney, Mike" <Toney.Mike@epa.gov>

Tue, Sep 4, 2018 at 7:51 AM

Hi Rafael,

I hope all is well. I wanted to check in and see how the review of the Owner's Manual and catalytic thermometer discussion were going and if there is anything additional information or material you may require. I recognize you need a mailed copy of the CBI report. We will send this ASAP when we receive acknowledgement that our proposed catalytic thermometer placement is acceptable.

Best regards,  
Ryan Fisher

[Quoted text hidden]

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**Sanchez, Rafael** <Sanchez.Rafael@epa.gov>

To: Ryan Fisher <ryan@mfire.com>

Cc: "Aldridge, Amanda" <Aldridge.Amanda@epa.gov>, Paul LaPorte <paul@mfire.com>, "Toney, Mike" <Toney.Mike@epa.gov>

Tue, Sep 4, 2018 at 12:36 PM

Hi Ryan,

35 Thank you for the additional information. I have reviewed the submitted information and after consultation with EPA, I am recommending certification. The next  
55 step is an internal management review. This step should take about two weeks. Let me know if you need additional information.

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**9. Revision History**

Date	Project No.	Tech. & Evaluator	Report Sect.	Summary of Changes
10/05/2023	0552WS003E (Edition 000)	R Tiegs K Morgan	ALL	First Issue of Report