
MF Fire

Project # 20-606

Model: Nova 2

Type: Single Burn Rate Catalytic
Wood-Fired Heater

July 7, 2020

ASTM E2780 – 10 Standard Test Method for Determining Particulate Matter Emissions from Wood Heaters

Issued to: Mr. Taylor Myers

MF Fire

3031 Washington Blvd, Suite G

Baltimore, MD 21230

(855) 633-4731

Prepared by: Aaron Kravitz, Testing
Supervisor



11785 SE Highway 212 – Suite 305

Clackamas, OR 97015-9050

(503) 650-0088

WWW.PFSTECO.COM

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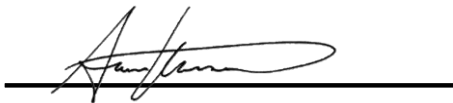
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Affidavit

PFS-TECO was contracted by MF Fire to provide testing services for the Nova 2 Wood-Fired Room Heater per ASTM E2780, *Standard Test Method for Determining Particulate Matter Emissions from Wood Heaters*. All testing and associated procedures were conducted at PFS-TECO's Hearth Products laboratory beginning on 6/10/2020 and ending on 6/18/2020. The laboratory is located at 11785 SE Hwy 212, Clackamas OR 97015. Testing procedures followed ASTM E2780. Particulate sampling was performed per ASTM E2515, *Standard Test Method for Determination of Particulate Matter Emissions Collected by a Dilution Tunnel*.

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

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



Aaron Kravitz, Testing Supervisor

Introduction

MF Fire of Baltimore, MD contracted with PFS-TECO to perform EPA certification testing on the model Nova 2 Wood-Fired Room Heater. All testing was performed at PFS-TECO's Portland Laboratory in Clackamas, OR. All testing was performed by Aaron Kravitz.

Notes

- Prior to start of testing, 50 hours of conditioning was performed per ASTM E2780.
- Prior to start of testing, the dilution tunnel was cleaned with a steel brush.
- Front filters were changed on sample train A at one hour for all 5 test runs.
- A total of 5 test runs were completed. Test runs were performed in accordance with ASTM E2780 for a single burn rate appliance. The first two runs were conducted without a critical emissions control component installed, so these runs were not included in the average. Certification runs consisted of two replicate runs and one fan confirmation run. See the Run Narrative section for further detail on each run.

Wood Heater Identification and Testing

- Appliance Tested: ***Nova 2***
- Serial Number: ***Un-serialized Prototype – PFS Tracking Number 0074***
- Manufacturer: ***MF Fire***
- Catalyst: ***Yes***
- Variable Burn Rate: ***No***
- Heat exchange blower: ***Optional***
- Type: ***Wood Stove***
- Style: ***Free Standing***
- Date Received: ***Wednesday, June 03, 2020***
- Testing Period – Start: ***Wednesday, June 10, 2020***
Finish: ***Thursday, June 18, 2020***
- Test Location: ***PFS-TECO***
11785 SE Hwy 212, Suite 305
Clackamas, OR 97015
- Elevation: ***~131 Feet above sea level***
- Test Technician(s): ***Aaron Kravitz***
- Observers: ***None***

Test Procedures and Equipment

All Sampling and analytical procedures were performed by Aaron Kravitz. All procedures used are directly from ASTM E2780 and ASTM E2515. See the list below for equipment used. See Appendix C submitted with this report for calibration data.

Equipment List:

Equipment ID#	Equipment Description
041	Rice Lake 3'x3' floor scale w/digital weight indicator
132	Digiweigh DWP-440 Platform Scale
53	APEX XC-60-ED Digital Emissions Sampling Box A
54	APEX XC-60-ED Digital Emissions Sampling Box B
57	California Analytical ZRE CO ₂ /CO/O ₂ IR ANALYZER
064	Digital Barometer
109A/B	Troemner 100mg/200mg Audit Weights
107	Sartorius Analytical Balance
051	10 lb audit weight
101	Dewalt Tape Measure
117	Digital Calipers
095	Anemometer
111	Microtector
115	Delmhorst Wood Moisture Meter
92302052	Gas Analyzer Calibration Span Gas
91005049	Gas Analyzer Calibration Mid Gas

Results

The average emissions rate for the 2 run test series was measured to be **1.9 g/hr** with a Higher Heating Value efficiency of **75%**. The average CO emission rate for the 2 tests was **0.8 g/min**. The MF Fire model Nova 2 Wood-Fired Room Heater meets the 2020 crib wood PM emission standard of ≤ 2.0 g/hr per CFR 40 part 60, §60.532 (c).

Detailed individual run data can be found in Appendix A submitted with this report.

Summary Table

	<i>Run 1 Not used*</i>	<i>Run 2 Not used*</i>	Run 3 Certification #1	Run 4 Certification #2	Run 5 Fan Confirmation
Date	6/10/2020	6/11/2020	6/16/2020	6/17/2020	6/18/2020
Run Number	1	2	3	4	5
Emission Rate (g/hr)	3.03	2.67	2.08	1.78	1.96
Burn Rate (kg/hr)	2.74	2.76	2.23	2.70	2.29
Heat Output (Btu/hr)	35,011	36,968	31,529	38,037	31,205
Overall Efficiency (% HHV)	68.5%	71.9%	75.1%	75.3%	75.5%
CO Emissions (g/MJ Output)	3.19	3.32	1.03	1.42	0.53
CO Emissions (g/kg Dry Fuel)	43.34	47.24	15.39	21.12	7.88
CO Emissions (g/min)	1.97	2.15	0.57	0.95	0.29
Emissions Rate – First Hour (g/hr)	4.84	3.24	4.01	2.31	1.84
Particulate emission average of 2 test runs: 1.9 grams per hour.					
Weighted average HHV efficiency of 2 test runs: 75%.					
Average CO emissions of 2 test runs: 0.8 g/min.					

*Runs 1 and 2 were conducted without the catalyst shield installed due to technician oversight. As this shield is a critical emissions control component, these runs are not acceptable for certification use and are shown here for information only.

Test Run Narrative

Run 1

Run 1 was performed on 6/10/2020, in accordance with the procedures specified in ASTM E2780 for a single burn rate appliance. The total test time was 137 minutes. The particulate emissions rate for the test was 3.03 g/hr, the burn rate was 2.74 kg/hr with an HHV efficiency of 68.5%. The Train A front filter was changed at 1 hr to determine 1st hour emissions. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

Run 2

Run 2 was performed on 6/11/2020, in accordance with the procedures specified in ASTM E2780 for a single burn rate appliance. The total test time was 136 minutes. The particulate emissions rate for the test was 2.67 g/hr, the burn rate was 2.76 kg/hr with an HHV efficiency of 71.9%. The Train A front filter was changed at 1 hr to determine 1st hour emissions. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

Following Run 2

After the completion of test run #2, the manufacturer requested that the unit be examined for potential causes of higher than anticipated emissions rates. This examination revealed that the catalyst heat shield (shown below in its proper position) was not installed.



This was determined to be an oversight in setting the stove up for testing after shipment. This shield is a critical emissions component, so testing was halted, and the EPA contacted for approval to restart certification testing. With this approval, the shield was installed in accordance with the manufacturer's instructions and testing continued.

Run 3

Run 3 was performed on 6/16/2020, in accordance with the procedures specified in ASTM E2780 for a single burn rate appliance. The total test time was 163 minutes. The particulate emissions rate for the test was 2.08 g/hr, the burn rate was 2.23 kg/hr with an HHV efficiency of 75.1%. The Train A front filter was changed at 1 hr to determine 1st hour emissions. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

Run 4

Run 4 was performed on 6/17/2020, in accordance with the procedures specified in ASTM E2780 for a single burn rate appliance. The total test time was 126 minutes. The particulate emissions rate for the test was 1.78 g/hr, the burn rate was 2.70 kg/hr with an HHV efficiency of 75.3%. The Train A front filter was changed at 1 hr to determine 1st hour emissions. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

Run 5

Run 5 was performed to confirm emissions performance without a fan (fan confirmation) on 6/18/2020, in accordance with the procedures specified in ASTM E2780 for a single burn rate appliance. The total test time was 147 minutes. The particulate emissions rate for the test was 1.96 g/hr, the burn rate was 2.29 kg/hr with an HHV efficiency of 75.5%. The Train A front filter was changed at 1 hr to determine 1st hour emissions. All test results were appropriate and valid. There were no anomalies and all test criteria were met. Since the emissions rate is within 1.0 g/hr of the other test runs used for determining the average rate, the fan is not considered to have an effect on emissions and can therefore be sold as optional equipment.

Test Conditions Summary

Testing conditions for all runs fell within allowable specifications of ASTM E2780 and ASTM E2515. A summary of facility conditions, fuel burned, and run times is listed below.

Runs	Ambient (°F)		Relative Humidity (%)		Average Barometric Pressure (In. Hg.)	Preburn Fuel Weight (lbs)	Test Fuel Weight (lbs)	Test Fuel Moisture (%DB)	Test Run Time (Min)
	Pre	Post	Pre	Post					
1	74	79	65.5	48.7	30.10	14.3	16.68	21.3	137
2	78	80	51.4	37.8	30.05	14.5	16.69	22.2	136
3	70	71	51.7	40.0	30.01	14.6	16.16	21.1	163
4	70	76	45.5	29.4	29.95	13.8	15.22	22.2	126
5	77	80	62.2	36.5	30.10	14.2	14.98	22.1	147

Appliance Operation and Test Settings

The appliance was operated according to procedures as described in the Operations Manual, found in Appendix B submitted with this report. Detailed run information can be found in Appendix A submitted with this report.

Appliance Description

Model(s): Nova 2

Appliance Type: Wood-Fired Room Heater

Firebox Volume: 2.4 ft³

Air Introduction System: All combustion air enters through a hole at the rear of the firebox and is channeled from there to the primary and secondary air systems. The primary air consists of an air wash over the loading door, while the secondary air enters through numerous perforations in a secondary air manifold that acts as the top of the firebox.

Baffles: The only baffling is the main catalyst enclosure/secondary air manifold

Refractory Insulation: The firebox is lined with 1.25" thick firebrick.

Flue Outlet: 6-inch exhaust outlet located on the top (configurable to rear) of the appliance.

Catalytic Combustor: Metallic substrate combustor located at the top of the firebox, mounted in the secondary manifold behind a shield.

Fan: The Nova 2 is available with a convection fan that attaches to the lower rear of the appliance.

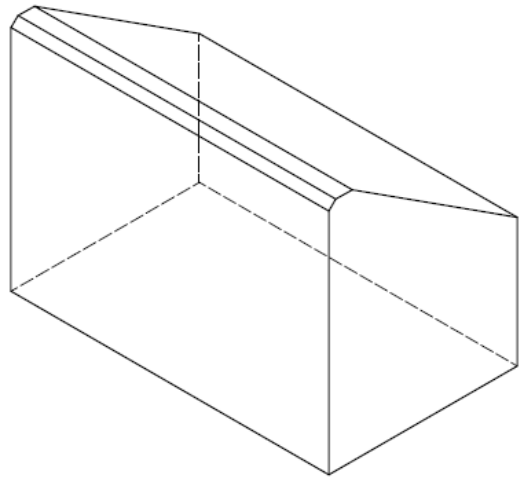
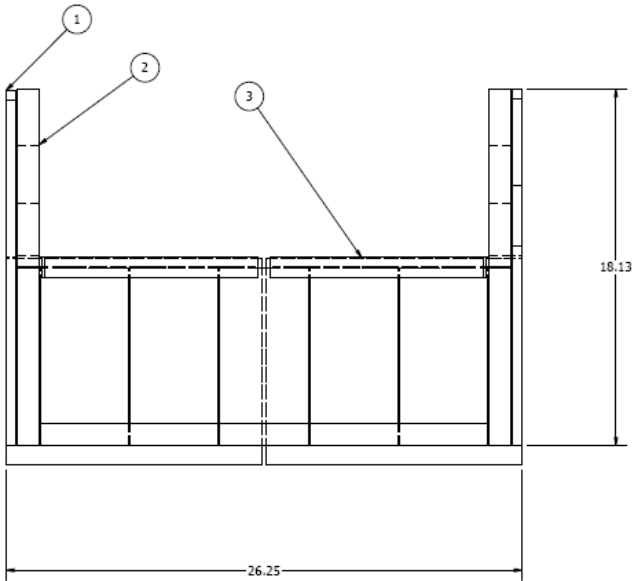
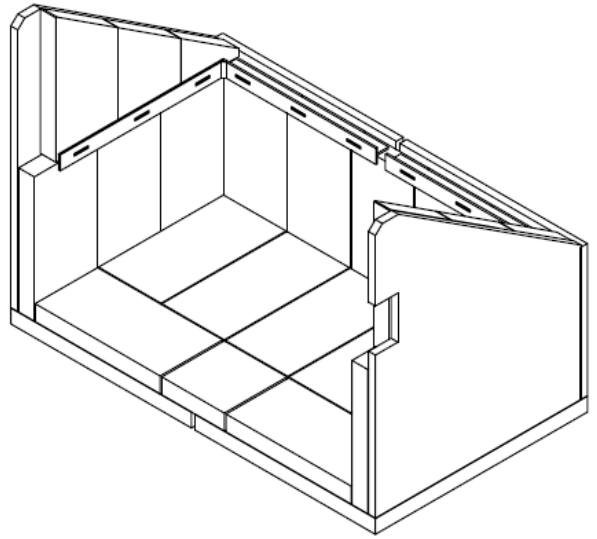
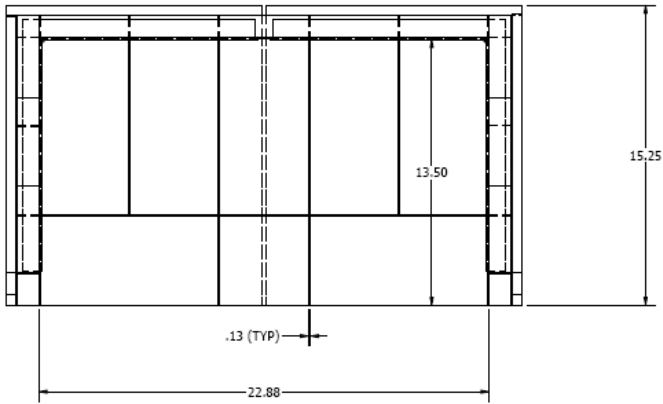
Appliance Dimensions

Nova 2 Unit Dimensions

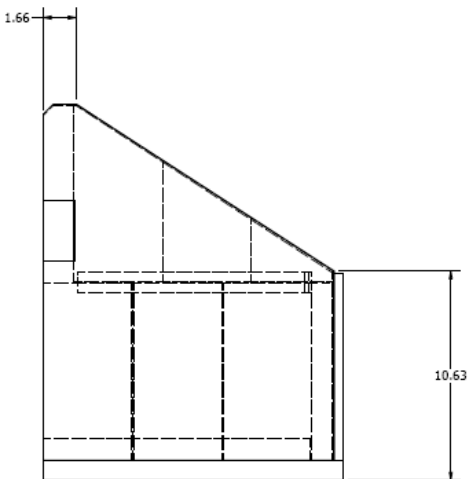
Height	Width	Depth	Firebox Volume
26.5"	27"	19"	2.4 ft ³

Appliance design drawings can be found in Appendix D submitted with the CBI copy of this report.

Firebox Drawing



SKETCH OF FIREBOX
FREE-SPACE VOLUME
FireBox Volume: 4,208.5 in³
2.4 ft³



Appliance Front



Appliance Left



Appliance Right



Appliance Rear



Test Fuel Properties

Test fuel used was dimensional Douglas fir lumber in 2" x 4" (nominal) and 4" x 4" (nominal). Test fuel was air dried to the specified moisture range of 19-25% dry basis. A typical fuel load is pictured below:

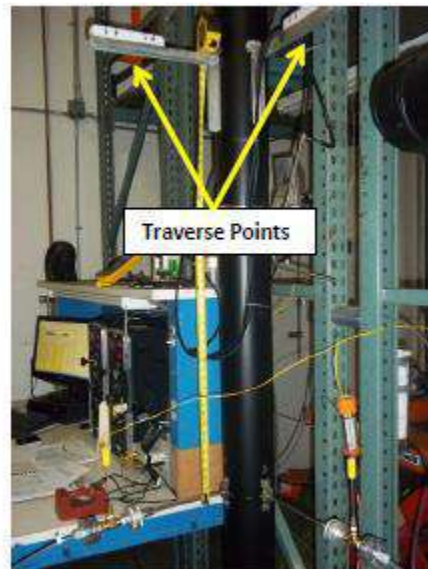
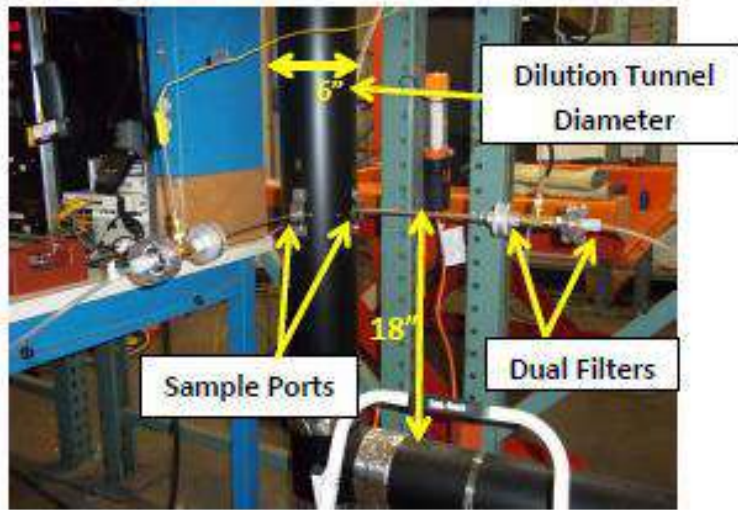
Typical Fuel Load



Sampling Locations and Descriptions

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

Sample Points



Sampling Methods

ASTM E2515 was used in collecting particulate samples. The dilution tunnel is 6 inches in diameter. All sampling conditions per ASTM E2515 were followed. No alternate procedures were used and no sampling intervals fell outside of proportional rates of +/- 10%.

Analytical Methods Description

All sample recovery and analysis procedures followed ASTM E2515 procedures. At the end of each test run, filters, O-Rings and probes were removed from their housings, dessicated for a minimum of 24 hours, and then weighed at 6 hour intervals to a constant weight per ASTM E2515-11 Section 10.

Calibration, Quality Control and Assurances

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

Appliance Sealing and Storage

Upon completion of testing, the appliance was secured with metal strapping and the seal below was applied, the appliance was then returned to the manufacturer’s location at: 3031 Washington Blvd, Suite G, Baltimore, MD 21230 for archival.

Sealing Label

ATTENTION:

THIS SEAL IS NOT TO BE BROKEN WITHOUT PRIOR AUTHORIZATION FROM THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY.

THIS APPLIANCE HAS BEEN SEALED IN ACCORDANCE WITH REQUIREMENTS OF 40CFR PART 60 SUBPART AAA §60.535 (a)(2)(vii)

REPORT # _____

DATE SEALED _____

MANUFACTURER _____

MODEL # _____

Sealed Unit



List of Appendices

The following appendices have been submitted electronically in conjunction with this report:

Appendix A – Test Run Data, Technician Notes, Sample Analysis, and Alternate Test Method Approval

Appendix B – Labels and Manuals

Appendix C – Equipment Calibration Records

Appendix D – Design Drawings (CBI Report Only)

Appendix E – Manufacturer QAP (CBI Report Only)

Appendix A

Test Run
Data, etc.

Sample Calculations – ASTM E2780 & E2515

Client: MF Fire _____
 Model: Nova 2 _____
 Run: 1 _____

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/ft³

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

ASTM E2780 equation (1)

$$M_{Sdb} = (M_{Swb})(100/(100 + FM_S))$$

Where,

FM_S = average fuel moisture of test fuel spacers, % dry basis

M_{Swb} = weight of test fuel spacers, wet basis, kg

Sample Calculation:

$$FM_S = 18.9 \%$$

$$M_{Swb} = 1.9 \text{ lbs}$$

0.4536 = Conversion factor from lbs to kg

$$M_{Sdb} = [(1.9 \times 0.4536) (100/(100 + 18.9))]$$

$$M_{Sdb} = \mathbf{0.74 \text{ kg}}$$

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):

$$\begin{aligned} M_{CPnwb} &= 4.48 \\ FM_{CPn} &= 20.1 \\ &= 4.5 (100/(100+ 20.1)) \\ &= 3.7 \text{ lbs} \end{aligned}$$

Total dry crib weight, excluding spacers = 12.19 lbs
M_{Cdb} = **5.53** kg

ASTM E2515 - O-Rings

Sample	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
1A	3579.6	3566.2	3566.7	3566.8	A	20-565	#4
1B	3554.6	3554.0	3555.0	-	A		
2A	3552.4	3552.5	-	-	A	20-601	#1
2B	3571.5	3571.6	-	-	A		
3A	3579.7	3579.8	-	-	A	20-601	#2
3B	3564.0	3568.2	-	-	A		
4A	3622.1	3623.6	3623.8	-	A	20-601	#3
4B	3579.9	3580.2	3580.7	-	A		
5A	3534.1	3534.9	3535.0	-	A		
5B	3530.6	3531.4	3531.5	-	A		

Weight 1 Date/Time: 4/23 16:00
Weight 2 Date/Time: 4/24 0830
Weight 3 Date/Time: 4/25 12:00
Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
6A	3612.5	3612.6	-	-	SB	20-604	#1
6B	3390.9	3392.0	3392.1	-	SB		
7A	3570.5	3570.6	-	-	SB	20-604	#2
7B	3520.2	3520.2	-	-	SB		
8A	3549.9	3549.6	3549.7	-	SB	20-604	#3
8B	3583.8	3583.3	3583.4	-	SB		
9A	3579.4	3579.4	-	-	SB	20-606	#1
9B	3522.4	3522.5	-	-	SB		
10A	3426.0	3426.8	3426.8	-	SB	20-606	#2
10B	3568.5	3568.6	-	-	SB		

Weight 1 Date/Time: 5/26/20 - 8:00
Weight 2 Date/Time: 5/27/20 - 9:00
Weight 3 Date/Time: 5/28/20 - 8:00
Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
11A	3416.1	3417.3	3417.5	-	A	20-606	#3
11B	4228.1	4229.3	4229.5	-	A		
12A	3398.9	3399.8	3399.9	-	A	20-606	#4
12B	3391.8	3392.1	3392.0	-	A		
13A	3355.8	3356.1	3356.2	-	A	20-606	#5
13B	3439.9	3440.5	3440.7	-	A		
14A	-	3362.5	3362.7	-	A		
14B	-	3337.2	3337.4	-	A		
15A	-	3567.6	3567.6	-	A		
15B	-	3568.4	3568.6	-	A		

Weight 1 Date/Time: 6/8 - 9:30
Weight 2 Date/Time: 6/10 - 8:00
Weight 3 Date/Time: 6/15 - 11:15
Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
16A							
16B							
17A							
17B							
18A							
18B							
19A							
19B							
20A							
20B							

Weight 1 Date/Time:
Weight 2 Date/Time:
Weight 3 Date/Time:
Weight 4 Date/Time:

D_{Cdb} - Density of fuel crib, excluding spacers and nails, dry basis, lbs/ft³
ASTM E2780 equation (3)

$$D_{Cdb} = M_{Cdb} / V_C$$

Where,

$$V_C = \text{Volume of fuel crib, ft}^3$$

Sample calculation:

$$V_C = 644 \text{ in}^3$$

1728 = conversion from in³ to ft³

$$D_{Cdb} = 12.19 / 644 * 1728$$
$$= \mathbf{32.71 \text{ lbs/ft}^3}$$

M_{FTAdb} - Total weight of fuel crib excluding nails, dry basis, kg
ASTM E2780 equation (4)

$$M_{FTAdb} = M_{Sdb} + M_{Cdb}$$

Sample calculation:

$$\begin{aligned} M_{FTAdb} &= 0.74 + 5.53 \\ &= \mathbf{6.26 \text{ kg}} \end{aligned}$$

BR – dry burn rate, kg/hr

ASTM E2780 equation (5)

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

Where,

$$\theta = \text{Total length of test run, min}$$

Sample Calculation:

$$M_{Bdb} = 6.26 \quad \text{kg}$$

$$\theta = 137 \quad \text{min}$$

$$BR = \frac{60 \times 6.26}{137}$$

$$BR = \mathbf{2.74} \quad \text{kg/hr}$$

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

ASTM E2515 equations (9)

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

Where:

- F_p = Adjustment factor for pitot tube center point reading = $\frac{V_{strav}}{V_{scent}}$, ASTM E2515 Equation (1)
- V_{scent} = Dilution tunnel velocity calculated after the multi-point pitot traverse at the center, ft/sec
- V_{strav} = Dilution tunnel velocity calculated after the multi-point pitot traverse, ft/sec
- k_p = Pitot tube constant, 85.49
- C_p = Pitot tube coefficient: 0.99, unitless
- ΔP* = Velocity pressure in the dilution tunnel, in H₂O
- T_s = Absolute average gas temperature in the dilution tunnel, °R; (°R = °F + 460)
- P_s = Absolute average gas static pressure in dilution tunnel, = P_{bar} + P_g, in Hg
- P_{bar} = Barometric pressure at test site, in. Hg
- P_g = Static pressure of tunnel, in. H₂O; (in Hg = in H₂O/13.6)
- M_s =

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

Sample calculation:

$$F_p = \frac{17.58}{19.79} = 0.888$$

$$V_s = 0.888 \times 85.49 \times 0.99 \times 0.285 \times \left(\left(\frac{119.5}{30.10} + \frac{460}{13.6} \right) \times 28.78 \right)^{1/2}$$

$$V_s = 17.55 \text{ ft/s}$$

*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_s as the dry molecular weight. It should be the wet molecular weight as indicated in EPA Method 2.

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

ASTM E2515 equation (3)

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

Where:

- 3600 = Conversion from seconds to hours (ASTM method uses 60 to convert in minutes)
- B_{ws} = Water vapor in gas stream, proportion by volume; assume 2%
- A = Cross sectional area of dilution tunnel, ft²
- T_{std} = Standard absolute temperature, 528 °R
- P_s = Absolute average gas static pressure in dilution tunnel, = P_{bar} + P_g, in Hg
- T_{s(avg)} = Absolute average gas temperature in the dilution tunnel, °R; (°R = °F + 460)
- P_{std} = Standard absolute pressure, 29.92 in Hg

Sample calculation:

$$Q_{sd} = 3600 \times (1 - 0.02) \times 17.55 \times 0.1963 \times \frac{528}{119.5 + 460} \times \frac{30.10 + \frac{-0.17}{13.6}}{29.92}$$

Q_{sd} = **11136.5** dscf/hr

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

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

Where:

- K_1 = 17.64 °R/in. Hg
 V_m = Volume of gas sample measured at the dry gas meter, dcf
 Y = Dry gas meter calibration factor, dimensionless
 P_{bar} = Barometric pressure at the testing site, in. Hg
 ΔH = Average pressure differential across the orifice meter, in. H₂O
 T_m = Absolute average dry gas meter temperature, °R

Sample Calculation:

Using equation for Train 1:

$$V_{m(std)} = 17.64 \times 18.523 \times 0.998 \times \frac{\left(30.10 + \frac{1.84}{13.6} \right)}{\left(92.1 + 460 \right)}$$

$$V_{m(std)} = \mathbf{17.856} \text{ dscf}$$

Using equation for Train 2:

$$V_{m(std)} = 17.64 \times 18.404 \times 1.002 \times \frac{\left(30.10 + \frac{1.84}{13.6} \right)}{\left(93.9 + 460 \right)}$$

$$V_{m(std)} = \mathbf{17.752} \text{ dscf}$$

Using equation for ambient train:

$$V_{m(std)} = 17.64 \times 0.00 \times 1 \times \frac{\left(\underline{30.095} + \frac{0.00}{13.6} \right)}{\left(77.0 + 460 \right)}$$

$$V_{m(std)} = \mathbf{0} \text{ dscf}$$

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 A (first hour):

$$m_n = 0.0 + 3.4 + 0.0$$

$$m_n = 3.4 \text{ mg}$$

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

$$m_n = 0.1 + 0.8 + 0.8$$

$$m_n = 1.7 \text{ mg}$$

Train A aggregate:

$$m_n = 3.4 + 1.7$$

$$m_n = 5.1 \text{ mg}$$

Using equation for Train B:

$$m_n = 0.6 + 3.4 + 0.6$$

$$m_n = 4.6 \text{ mg}$$

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

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

Where:

- K₂ = Constant, 0.001 g/mg
- m_n = Total mass of particulate matter collected in the sampling train, mg
- V_{m(std)} = Volume of gas sampled corrected to dry standard conditions, dscf

Sample calculation:

For Train 1:

$$C_s = 0.001 \times \frac{5.1}{17.86}$$

$$C_s = \mathbf{0.00029} \text{ g/dscf}$$

For Train 2

$$C_s = 0.001 \times \frac{4.6}{17.75}$$

$$C_s = \mathbf{0.00026} \text{ g/dscf}$$

For Ambient Train

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

$$C_r = \mathbf{0} \text{ g/dscf}$$

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
- θ = Total time of test run, minutes

Sample calculation:

For Train 1

$$E_T = (0.000286 - 0) \times 11136.5 \times 137 / 60$$

$$E_T = \mathbf{7.26} \text{ g}$$

For Train 2

$$E_T = (0.000259 - 0) \times 11136.5 \times 137 / 60$$

$$E_T = \mathbf{6.59} \text{ g}$$

Average

$$E = \mathbf{6.93} \text{ g}$$

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

- 7.5% of the average = **0.52**
- Train 1 difference = **0.34**
- Train 2 difference = **0.34**

PR - Proportional Rate Variation

ASTM E2515 equation (16)

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

Where:

- θ = Total sampling time, min
- θ_i = Length of recording interval, min
- V_{mi} = Volume of gas sample measured by the dry gas meter during the "ith" time interval, dcf
- V_m = Volume of gas sample as measured by dry gas meter, dcf
- V_{si} = Average gas velocity in the dilution tunnel during the "ith" time interval, ft/sec
- V_s = Average gas velocity in the dilution tunnel, ft/sec
- T_{mi} = Absolute average dry gas meter temperature during the "ith" time interval, °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):

$$PR = \left(\frac{137 \times 0.124 \times 17.55 \times (145.0 + 460) \times (92.1 + 460)}{1 \times 18.523 \times 16.74 \times (119.5 + 460) \times (80.0 + 460)} \right) \times 100$$

PR = **103 %**

PM_R – Particulate emissions for test run, g/hr

ASTM E2780 equation (6)

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

Where,

E_T = Total particulate emissions, grams

θ = Total length of full integrated test run, min

Sample Calculation:

$$E_T \text{ (Dual train average)} = 6.93 \text{ g}$$

$$\theta = 137 \text{ min}$$

$$PM_R = 60 \times (6.93 / 137)$$

$$PM_R = 3.03 \text{ g/hr}$$

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

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

Sample Calculation:

$$\begin{aligned} E_T (\text{Dual train average}) &= 6.93 \text{ g} \\ M_{Bdb} &= 6.26 \text{ kg} \\ \\ PM_F &= 6.93 / 6.26 \\ \\ PM_F &= 1.11 \text{ g/kg} \end{aligned}$$

ASTM E2515 - Glass Filters

Sample	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
A001	118.3	118.1	-	-	SB	20-565	#1
A002	119.3	119.1	-	-	SB	↓	↓
A003	119.4	119.5	-	-	SB	↓	#2
A004	118.3	118.2	-	-	SB	↓	↓
A005	119.5	119.6	-	-	SB	↓	#3
A006	119.6	119.7	-	-	SB	↓	↓
A007	119.0	118.9	-	-	SB	↓	#4
A008	118.8	118.9	-	-	SB	↓	↓
A009	119.4	119.5	-	-	SB	20-606	#1
A010	118.8	118.7	-	-	SB	↓	↓
A011	119.5	119.3	-	-	SB	↓	↓
A012	120.3	120.3	-	-	SB	↓	↓
A013	120.6	120.5	-	-	SB	↓	↓
A014	120.5	120.6	-	-	SB	20-606	#2
A015	120.5	120.5	-	-	SB	↓	↓
A016	120.0	120.0	-	-	SB	↓	↓
A017	119.6	119.8	-	-	SB	↓	↓
A018	121.2	121.4	-	-	SB	↓	↓

Weight 1 Date/Time:
4/27- 13:00
Weight 2 Date/Time:
4/28- 8:00
Weight 3 Date/Time:
Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
A019	118.6	118.5	-	-	SB	20-606	#3
A020	119.9	119.7	-	-	SB	↓	↓
A021	120.4	120.3	-	-	SB	↓	↓
A022	119.0	119.0	-	-	SB	↓	↓
A023	119.5	119.4	-	-	SB	↓	↓
A024	119.7	119.5	-	-	SB	20-606	#4
A025	120.2	120.3	-	-	SB	↓	↓
A026	118.6	118.5	-	-	SB	↓	↓
A027	118.5	118.5	-	-	SB	↓	↓
A028	119.6	119.7	-	-	SB	↓	↓
A029	119.9	120.0	-	-	SB	20-606	#5
A030	118.4	118.3	-	-	SB	↓	↓
A031	119.6	119.5	-	-	SB	↓	↓
A032	119.7	119.6	-	-	SB	↓	↓
A033	119.2	119.7	-	-	SB	↓	↓
A034	117.4	117.5	-	-	SB	↓	↓
A035	121.1	121.0	-	-	SB	↓	↓
A036	119.2	119.3	-	-	SB	↓	↓

Weight 1 Date/Time:
4/27- 13:00
Weight 2 Date/Time:
4/28- 8:00
Weight 3 Date/Time:
Weight 4 Date/Time:

ASTM E2515 - Probes

Sample	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
1A	115628.0	115627.9	-	-	A	20-565	#4
1B	1159011.6	115900.4	-	-	A		
2A	116239.6	116239.5	-	-	A	20-601	#1
2B	116328.7	116328.5	-	-	A		
3A	116074.0	116073.9	-	-	1	20-601	#2
3B	116338.8	116338.9	-	-	1		
4A	116183.2	116182.0	116183.1	-	A	20-601	#3
4B	116366.4	116366.4	116366.6	-	A		
5A	116767.1	116766.4	116767.0	-	A	-	-
5B	116874.9	116874.4	116874.6	-	A	-	-

Weight 1 Date/Time:
4/23 17:00

Weight 2 Date/Time:
4/24 08:30

Weight 3 Date/Time:
4/26 09:30

Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
6A	116544.0	116543.9	-	-	SB	20-604	#1
6B	116118.2	116118.1	-	-	SB		
7A	116739.4	116739.3	-	-	SB	20-604	#2
7B	117286.9	117286.8	-	-	SB		
8A	116829.8	116829.7	-	-	SB	20-604	#3
8B	116827.0	116826.5	116826.6	-	SB		
9A	117713.3	117713.7	-	-	SB	20-606	#1
9B	117918.8	117918.6	-	-	SB		
10A	116819.6	116819.7	-	-	SB	20-606	#2
10B	117903.6	117903.5	-	-	SB		

Weight 1 Date/Time:
5/26/20 8:00

Weight 2 Date/Time:
5/27/20 9:00

Weight 3 Date/Time:
5/28/20 8:00

Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
11A	117036.5	117036.7	-	-	SB	20-606	#3
11B	117490.8	117490.9	-	-	SB		
12A	116890.0	116890.0	-	-	SB	20-606	#4
12B	117942.2	117942.0	-	-	SB		
13A	117457.6	117457.5	-	-	SB	20-606	#5
13B	117056.1	117055.9	-	-	SB		
14A	-	116818.1	116818.1	-	A	-	-
14B	-	116771.7	116771.6	-	A	-	-
15A	-	117418.5	117418.7	-	A	-	-
15B	-	116905.3	116906.0	-	A	-	-

Weight 1 Date/Time:
6/8-9:30

Weight 2 Date/Time:
6/9-9:30

Weight 3 Date/Time:
6/15 11:15

Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
16A							
16B							
17A							
17B							
18A							
18B							
19A							
19B							
20A							
20B							

Weight 1 Date/Time:

Weight 2 Date/Time:

Weight 3 Date/Time:

Weight 4 Date/Time:

Form P407 ASTM E2780 Run Notes

Client: MF Fire Job Number: 20-606 Tracking #: 74
 Model: Nova 2 Run Number: 1 Test Date: 6/10/20

Test Control Settings

Primary Air Setting(s): N/A - Fixed
 Targeted Burn Category: N/A - Single BR

Preburn Notes

Time	Notes
	-None-

Test Notes

Test Burn Start Time: 11:36 Test Fuel Loaded by: 45 seconds
 Door Closed: 3:30 seconds Air Control Set at: N/A seconds
 Other Loading Notes: Fan on high

Time	Notes
60:00	Changed filter A

Test Burn End Time: 13:53

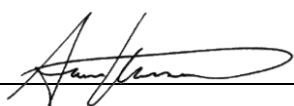
Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO₂ (%): 16.90 CO (%): 4.18
 Mid Gas CO₂ (%): 10.00 CO (%): 2.51

Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	9:59	10:02	10:01	14:08	14:05	14:06
CO ₂	0.00	9.96	16.90	0.00	10.06	16.83
CO	0.000	2.429	4.174	0.016	2.514	4.179

Flue Gas Probe Leak Check: Initial: No Leakage Final: No Leakage

Technician Signature: 

Date: 7/1/2020

Form P407 ASTM E2780 Run Notes

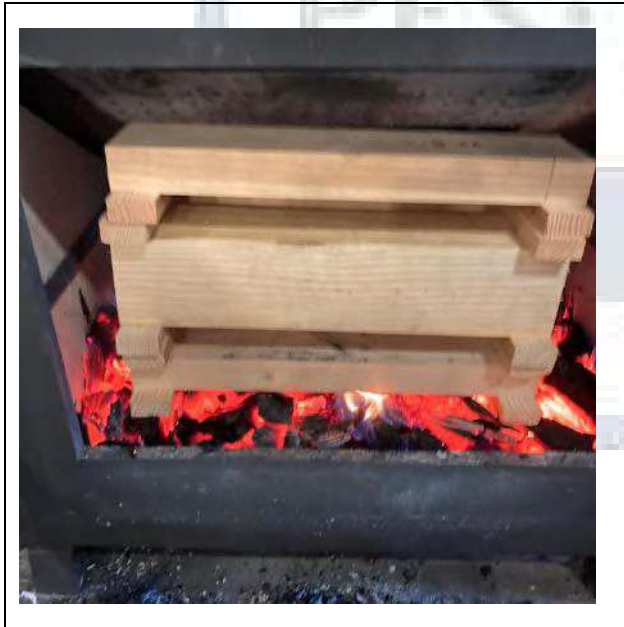
Client: MF Fire Job Number: 20-606 Tracking #: 74
Model: Nova 2 Run Number: 1 Test Date: 6/10/20



Test Fuel Front View



Test Fuel Iso View



Test Fuel Loaded in Stove

Technician Signature: 

Date: 7/1/2020

**WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515**



Run 2 Data Summary

Client:	MF Fire
Model:	Nova 2
Job #:	20-606
Tracking #:	74
Test Date:	6/11/2020

A handwritten signature in black ink, appearing to read "A. J. [unclear]", is written over a horizontal line.

Techician Signature

7/1/2020
Date

TEST RESULTS - ASTM E2780 / ASTM E2515

Client: MF Fire

Model: Nova 2

Run #: 2

Job #: 20-606

Tracking #: 74

Technician: A Kravitz

Date: 6/11/2020

Burn Rate (kg/hr):	2.76
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	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft ³)	0.000	18.461	18.369	8.069
Average Gas Velocity in Dilution Tunnel (ft/sec)	16.7			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	10616.8			
Average Gas Meter Temperature (°F)	79.3	93.8	95.2	85.9
Total Sample Volume (dscf)	0.000	17.715	17.654	7.855
Average Tunnel Temperature (°F)	118.6			
Total Time of Test (min)	136			
Total Particulate Catch (mg)	0.0	4.5	4.4	2.4
Particulate Concentration, dry-standard (g/dscf)	0.0000000	0.0002540	0.0002492	0.0003055
Total PM Emissions (g)	0.00	6.11	6.00	3.24
Particulate Emission Rate (g/hr)	0.00	2.70	2.65	3.24
Emissions Factor (g/kg)	-	0.98	0.96	-
Difference from Average Total Particulate Emissions (g)	-	0.06	0.06	-
Difference from Average Emissions Factor (g/kg)	-	0.01	0.01	-

Final Average Results	
Total Particulate Emissions (g)	6.06
Particulate Emission Rate (g/hr)	2.67
Emissions Factor (g/kg)	0.97
HHV Efficiency (%)	71.9%
LHV Efficiency (%)	77.8%
CO Emissions (g/min)	2.15

Quality Checks	Requirement	Observed	Result
Dual Train Precision	Each train within 7.5% of average emissions (in grams), or emission factors within 0.5 g/kg	See Above	OK
Filter Temps	<90 °F	83.0	OK
Face Velocity	< 30 ft/min	7.6	OK
Leakage Rate	Less than 4% of average sample rate	0 cfm	OK
Ambient Temp	55-90 °F	Min: 77 / Max: 81	OK
Negative Probe Weight Evaluation	<5% of Total Catch	Probe Catch Not Negative	OK
Pro-Rate Variation	90% of readings between 90-110%; none greater than 120% or less than 80%	See Data Tabs	OK
Stove Surface ΔT	<126°F	11.8	OK

B415.1 Efficiency Results

Manufacturer: MF Fire
Model: Nova 2
Date: 06/11/20
Run: 2
Control #: 20-606
Test Duration: 136
Output Category: 4

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	71.9%	77.8%
Combustion Efficiency	96.8%	96.8%
Heat Transfer Efficiency	74.3%	80.3%

Output Rate (kJ/h)	38,970	36,968	(Btu/h)
Burn Rate (kg/h)	2.73	6.03	(lb/h)
Input (kJ/h)	54,171	51,387	(Btu/h)

Test Load Weight (dry kg)	6.20	13.66	dry lb
MC wet (%)	18.20		
MC dry (%)	22.25		
Particulate (g)	6.06		
CO (g)	293		
Test Duration (h)	2.27		

Emissions	Particulate	CO
g/MJ Output	0.07	3.32
g/kg Dry Fuel	0.98	47.24
g/h	2.67	129.19
g/min	0.04	2.15
lb/MM Btu Output	0.16	7.70

Air/Fuel Ratio (A/F)	11.31
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VERSION:

2.2

12/14/2009

WOODSTOVE FUEL DATA - ASTM E2780

Client: MF Fire
 Model: Nova 2
 Run #: 2

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/11/2020

Preburn Fuel Information						
Size	Length (in)	Moisture Content (% DB)		Size	Length (in)	Moisture Content (% DB)
2x4	16.00	21.0		2x4	10.00	24.0
2x4	16.00	21.0		2x4	10.00	19.0
2x4	16.00	22.0		2x4	10.00	19.0
2x4	16.00	19.0				
2x4	10.00	24.0				
2x4	10.00	24.0				
2x4	10.00	22.0				
2x4	10.00	21.0				
Total Fuel Weight (lbs):		14.47	Average Moisture (%DB):		21.5	

Firebox Volume (ft³): 2.40
 Total 2x4 Crib Weight, with spacers (lbs): 6.83
 Total 4x4 Crib Weight, with spacers (lbs): 9.86
 Total Wet Fuel Weight, with spacers (lbs): 16.69

Coal Bed Range (20-25%):
 Min (lbs): 3.34
 Max (lbs): 4.17

Test Fuel Information						
Size	Length (in)	Weight (lbs)	Moisture Content (%DB)			Dry Weight (lbs)
4x4	16.00	4.69	20.8	23.0	21.9	3.85
4x4	16.00	4.50	22.4	22.0	22.4	3.68
2x4	16.00	2.02	18.9	19.5	19.5	1.69
2x4	16.00	1.98	24.5	23.8	23.0	1.60
2x4	16.00	1.67	24.4	23.8	23.8	1.35
Total Dry Weight, no spacers (lbs):						12.17
Total Dry Weight, with spacers (lbs):						13.77

Spacer Moisture Readings (%DB)						
14.0						

Quality Checks	Requirement	Observed	Result
Fuel Density	25 - 36 (lbs/ft ³ , DB)	32.6	OK
Loading Density	6.3 - 7.7 (lbs/ft ³ , WB)	6.95	OK
2x4 Fuel Mix	35 - 65 % of total weight	41%	OK

DILUTION TUNNEL & MISC. DATA - ASTM E2780 / E2515

Client: MF Fire	Job #: 20-606
Model: Nova 2	Tracking #: 74
Run #: 2	Technician: A Kravitz
Test Start Time:	Date: 6/11/2020

Total Sampling Time (min): 136		Pre-Test	Post Test	Avg.
Recording Interval (min): 1		Barometric Pressure (in. Hg): 30.08	30.02	30.05
Meter Box γ Factor: 0.998 (A)		Relative Humidity (%): 51.4	37.8	
Meter Box γ Factor: 1.002 (B)		Room Air Velocity (ft/min): 0	0	
Meter Box γ Factor: 1.000 (Ambient)		Scale Audit (lbs): 10.0	10.0	
		Ambient Sample Volume:		ft ³

Induced Draft Check (in. H₂O): 0
 Smoke Capture Check (%): 100%
 Date Flue Pipe Last Cleaned: 6/4/2020

Sample Train Post-Test Leak Checks

(A)		cfm @		in. Hg
(B)		cfm @		in. Hg
(Ambient)		cfm @		in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H ₂ O)	Temp (°F)
1	0.048	122
2	0.068	122
3	0.072	122
4	0.040	122
5	0.048	122
6	0.070	122
7	0.070	122
8	0.040	122
Center	0.082	122

Dilution Tunnel H ₂ O:	2.00 percent
Tunnel Diameter:	6 inches
Pitot Tube Cp:	0.99 [unitless]
Dilution Tunnel MW(dry):	29.00 lb/lb-mole
Dilution Tunnel MW(wet):	28.78 lb/lb-mole
Tunnel Area:	0.1963 ft ²
V_{strav} :	16.83 ft/sec
V_{scent} :	19.88 ft/sec
F_p :	0.847 [ratio]
Initial Tunnel Flow:	173.1 scf/min

Static Pressure: -0.180 in. H₂O

TEST FUEL PROPERTIES

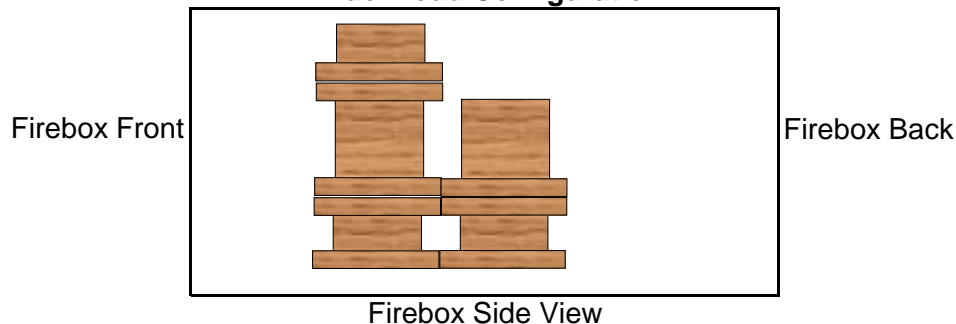
Default Fuel Values

	D. Fir	Oak
Fuel Type:	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

Actual Fuel Used Properties

	D. Fir
Fuel Type:	D. Fir
HHV (kJ/kg)	19,810
%C	48.73
%H	6.87
%O	43.9
%Ash	0.5
MC (%DB)	22.2

Fuel Load Configuration



WOODSTOVE PREBURN DATA - ASTM E2780

Client: MF Fire
 Model: Nova 2
 Run #: 2

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/11/2020

Recording Interval (min): 1
 Run Time (min): 107

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	Temperatures (°F)							Flue	Ambient
			FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average			
0	3.7	-0.003	247	229	240	685	158	311.8	449	74	
1	3.6	-0.001	250	228	242	681	159	312.0	445	75	
2	3.5	0.004	253	231	245	674	162	313.0	441	75	
3	3.4	0.002	255	233	247	667	164	313.2	437	75	
4	3.3	-0.002	257	230	250	656	166	311.8	434	75	
5	3.2	-0.005	260	239	252	647	168	313.2	428	75	
6	9.6	0.012	262	237	255	622	170	309.2	448	75	
7	3.2	0.000	264	239	257	594	173	305.4	429	75	
8	26.0	-0.002	267	241	259	568	176	302.2	427	75	
9	17.4	-0.003	269	244	261	554	178	301.2	405	75	
10	17.4	-0.003	271	245	262	542	181	300.2	417	75	
11	17.3	-0.081	273	246	265	532	183	299.8	419	75	
12	17.3	-0.078	275	247	266	523	186	299.4	419	75	
13	17.1	-0.072	276	248	243	496	187	290.0	423	75	
14	17.0	-0.071	277	248	231	476	189	284.2	418	75	
15	16.9	-0.078	277	248	219	461	190	279.0	415	75	
16	16.8	-0.081	278	247	208	452	191	275.2	413	75	
17	16.7	-0.076	278	247	201	443	193	272.4	405	75	
18	16.7	-0.070	278	246	193	432	194	268.6	399	75	
19	16.5	-0.073	277	246	188	424	195	266.0	393	75	
20	16.3	-0.079	277	244	183	415	196	263.0	394	75	
21	16.2	-0.066	277	243	192	426	198	267.2	386	75	
22	16.1	-0.070	276	237	184	411	199	261.4	389	75	
23	16.1	-0.076	276	239	180	402	201	259.6	389	76	
24	15.9	-0.084	276	239	176	395	201	257.4	390	75	
25	15.9	-0.069	274	238	171	391	202	255.2	391	75	
26	15.8	-0.077	274	237	168	388	203	254.0	393	75	
27	15.6	-0.082	272	236	165	387	204	252.8	395	75	
28	15.5	-0.072	272	233	162	385	205	251.4	400	75	
29	15.4	-0.073	270	232	160	391	206	251.8	397	75	
30	15.3	-0.075	270	230	159	398	207	252.8	399	75	
31	15.1	-0.075	269	227	158	404	209	253.4	402	76	
32	15.0	-0.072	268	227	155	410	210	254.0	404	75	
33	14.9	-0.073	268	227	154	411	211	254.2	408	75	
34	14.8	-0.073	266	226	153	414	211	254.0	410	75	
35	14.6	-0.076	266	225	152	415	212	254.0	411	75	
36	14.5	-0.068	266	222	151	423	213	255.0	412	75	
37	14.3	-0.078	265	222	150	429	214	256.0	415	75	
38	14.2	-0.073	265	221	149	434	214	256.6	418	75	
39	14.0	-0.081	265	220	149	438	216	257.6	421	76	
40	13.7	-0.081	265	219	148	436	217	257.0	420	75	
41	13.8	-0.079	265	218	148	429	218	255.6	416	75	
42	13.7	-0.083	265	217	147	423	218	254.0	416	76	
43	13.5	-0.074	265	218	148	419	220	254.0	415	75	
44	13.4	-0.070	265	217	147	416	221	253.2	414	76	

WOODSTOVE PREBURN DATA - ASTM E2780

Client: MF Fire
 Model: Nova 2
 Run #: 2

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/11/2020

Recording Interval (min): 1
 Run Time (min): 107

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	Temperatures (°F)							Flue	Ambient
			FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average			
45	13.3	-0.076	265	216	148	411	223	252.6	416	76	
46	13.1	-0.077	265	215	148	411	224	252.6	419	76	
47	12.9	-0.076	264	214	147	418	224	253.4	420	75	
48	12.9	-0.080	264	215	147	420	226	254.4	425	75	
49	12.7	-0.073	264	216	146	430	227	256.6	427	75	
50	12.6	-0.070	263	215	147	443	228	259.2	428	76	
51	12.4	-0.074	264	214	146	458	229	262.2	429	76	
52	12.3	-0.079	264	214	146	478	230	266.4	433	76	
53	12.0	-0.068	264	214	146	494	231	269.8	438	75	
54	11.9	-0.069	264	214	146	506	232	272.4	442	75	
55	11.6	-0.077	264	214	147	517	233	275.0	443	76	
56	11.5	-0.075	265	215	147	530	233	278.0	444	76	
57	11.3	-0.069	266	215	147	539	234	280.2	447	76	
58	11.2	-0.072	267	213	149	550	236	283.0	452	76	
59	11.1	-0.078	267	212	150	562	238	285.8	455	76	
60	10.9	-0.081	268	216	149	572	239	288.8	456	76	
61	10.7	-0.077	270	218	150	577	239	290.8	458	76	
62	10.6	-0.079	271	218	151	589	241	294.0	462	76	
63	10.4	-0.082	271	219	151	598	242	296.2	467	76	
64	10.2	-0.077	273	221	152	606	243	299.0	469	76	
65	10.0	-0.080	274	221	152	612	244	300.6	471	76	
66	9.9	-0.081	275	223	153	618	245	302.8	471	76	
67	9.6	-0.077	276	224	154	625	245	304.8	472	76	
68	9.5	-0.075	277	226	154	631	246	306.8	472	76	
69	9.4	-0.084	279	228	155	635	247	308.8	474	76	
70	9.2	-0.081	281	227	156	640	248	310.4	474	77	
71	9.0	-0.087	283	230	157	643	249	312.4	476	77	
72	8.9	-0.076	284	232	158	646	250	314.0	478	76	
73	8.7	-0.093	286	233	158	654	251	316.4	480	76	
74	8.6	-0.080	287	234	159	660	252	318.4	483	77	
75	8.4	-0.087	290	236	160	666	253	321.0	490	76	
76	8.1	-0.085	291	237	160	677	254	323.8	496	77	
77	8.0	-0.083	292	239	161	688	254	326.8	501	77	
78	7.8	-0.092	293	238	162	698	255	329.2	503	77	
79	7.6	-0.083	296	240	164	704	257	332.2	506	77	
80	7.4	-0.090	298	242	164	711	258	334.6	508	77	
81	7.3	-0.088	299	245	166	719	259	337.6	509	77	
82	7.1	-0.081	302	248	167	723	260	340.0	510	77	
83	6.9	-0.091	304	248	168	725	261	341.2	511	77	
84	6.7	-0.084	305	249	169	730	262	343.0	510	77	
85	6.4	-0.089	308	251	170	732	263	344.8	509	77	
86	6.3	-0.083	309	253	171	733	264	346.0	511	78	
87	6.1	-0.082	312	256	172	731	264	347.0	510	77	
88	6.0	-0.087	315	257	173	728	266	347.8	506	77	
89	5.9	-0.081	318	259	174	720	266	347.4	501	77	

WOODSTOVE PREBURN DATA - ASTM E2780

Client: MF Fire
 Model: Nova 2
 Run #: 2

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/11/2020

Recording Interval (min): 1
 Run Time (min): 107

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	Temperatures (°F)							Flue	Ambient
			FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average			
90	5.7	-0.080	319	259	175	711	267	346.2	494	78	
91	5.6	-0.079	322	262	176	702	269	346.2	487	78	
92	5.4	-0.084	325	265	177	692	270	345.8	482	78	
93	5.3	-0.074	327	268	179	685	271	346.0	478	78	
94	5.2	-0.078	330	268	180	681	272	346.2	473	78	
95	5.2	-0.079	332	268	183	675	274	346.4	469	78	
96	5.0	-0.077	334	271	182	679	275	348.2	469	78	
97	4.9	-0.073	336	276	184	676	276	349.6	463	78	
98	4.8	-0.075	338	274	186	669	278	349.0	459	79	
99	4.6	-0.076	340	276	186	658	279	347.8	452	79	
100	4.6	-0.071	340	279	186	647	280	346.4	445	78	
101	4.6	-0.072	341	280	188	633	282	344.8	438	78	
102	4.5	-0.075	343	282	189	619	283	343.2	431	78	
103	4.6	-0.072	342	283	189	605	284	340.6	426	78	
104	4.4	-0.061	342	285	189	595	285	339.2	423	78	
105	4.3	-0.075	343	285	190	585	286	337.8	419	79	
106	4.3	-0.070	344	285	191	575	286	336.2	416	79	
107	4.2	-0.070	344	286	190	569	288	335.4	413	78	

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF FireJob #: 20-606Model: Nova 2Tracking #: 74Run #: 2Technician: A KravitzDate: 6/11/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.087	0.01	79	-0.12		16.7		139	412	77	78
1	0.124	0.124	0.080	1.84	79	-1	97	16.6	-0.1	143	383	79	78
2	0.257	0.133	0.077	1.84	79	-0.94	106	16.3	-0.3	147	418	81	78
3	0.392	0.135	0.091	1.81	79	-0.86	99	16.0	-0.3	152	528	82	78
4	0.522	0.130	0.081	1.85	79	-0.96	100	15.6	-0.4	134	485	80	77
5	0.659	0.137	0.084	1.86	79	-0.78	103	15.4	-0.2	127	456	80	78
6	0.791	0.132	0.076	1.80	79	-0.88	104	15.2	-0.2	125	452	81	78
7	0.924	0.133	0.080	1.85	79	-0.74	102	15.0	-0.2	124	478	82	78
8	1.059	0.135	0.084	1.84	79	-0.57	101	14.7	-0.3	125	496	82	79
9	1.192	0.133	0.083	1.84	80	-0.91	100	14.5	-0.2	125	507	82	78
10	1.325	0.133	0.083	1.85	80	-1.03	100	14.1	-0.4	125	515	82	78
11	1.463	0.138	0.082	1.85	80	-0.83	104	13.9	-0.2	125	514	82	79
12	1.594	0.131	0.082	1.88	80	-0.74	99	13.7	-0.2	126	515	82	78
13	1.730	0.136	0.080	1.87	81	-0.78	104	13.4	-0.3	126	519	82	78
14	1.864	0.134	0.087	1.84	81	-0.8	98	13.1	-0.3	127	522	82	77
15	1.995	0.131	0.082	1.87	81	-0.94	99	12.9	-0.2	127	522	82	77
16	2.132	0.137	0.080	1.87	81	-0.67	105	12.6	-0.3	128	524	82	78
17	2.265	0.133	0.082	1.87	82	-0.77	101	12.4	-0.2	128	527	82	78
18	2.399	0.134	0.086	1.85	82	-0.99	99	12.1	-0.3	127	528	82	79
19	2.536	0.137	0.079	1.89	82	-0.87	105	11.9	-0.2	127	529	82	78
20	2.668	0.132	0.075	1.88	82	-0.6	104	11.5	-0.4	128	530	82	78
21	2.805	0.137	0.073	1.86	83	-0.88	110	11.3	-0.2	128	530	82	79
22	2.940	0.135	0.082	1.86	83	-0.94	102	11.0	-0.3	128	531	82	78
23	3.073	0.133	0.079	1.80	83	-0.89	102	10.8	-0.2	128	530	82	79
24	3.209	0.136	0.074	1.83	84	-0.89	108	10.5	-0.3	128	529	82	78
25	3.341	0.132	0.080	1.84	84	-0.69	101	10.2	-0.3	129	529	82	78
26	3.474	0.133	0.083	1.83	84	-0.79	100	10.0	-0.2	129	527	82	79
27	3.609	0.135	0.083	1.83	85	-1.05	101	9.7	-0.3	129	526	82	78
28	3.742	0.133	0.079	1.85	85	-0.99	102	9.3	-0.4	129	526	82	79
29	3.876	0.134	0.089	1.85	85	-0.84	97	9.2	-0.1	129	525	82	79
30	4.013	0.137	0.087	1.86	86	-0.98	100	8.9	-0.3	129	524	82	79
31	4.144	0.131	0.084	1.85	86	-0.73	97	8.7	-0.2	129	522	82	78

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF FireJob #: 20-606Model: Nova 2Tracking #: 74Run #: 2Technician: A KravitzDate: 6/11/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
32	4.282	0.138	0.087	1.85	86	-0.94	101	8.4	-0.3	128	523	81	78
33	4.416	0.134	0.084	1.89	87	-0.93	99	8.1	-0.3	128	524	82	80
34	4.550	0.134	0.082	1.90	87	-0.84	100	7.9	-0.2	128	526	82	78
35	4.688	0.138	0.083	1.86	87	-1.05	103	7.8	-0.1	127	523	81	80
36	4.821	0.133	0.078	1.86	88	-0.98	102	7.6	-0.2	127	521	81	78
37	4.960	0.139	0.079	1.89	88	-0.75	106	7.4	-0.2	127	519	81	79
38	5.094	0.134	0.087	1.91	88	-0.86	97	7.2	-0.2	127	517	81	79
39	5.229	0.135	0.084	1.88	89	-0.83	99	7.0	-0.2	126	515	81	79
40	5.365	0.136	0.077	1.83	89	-0.68	105	6.8	-0.2	126	518	81	79
41	5.498	0.133	0.084	1.83	89	-0.91	98	6.6	-0.2	127	518	81	79
42	5.632	0.134	0.078	1.85	90	-0.66	102	6.5	-0.1	126	516	81	79
43	5.769	0.137	0.085	1.85	90	-0.64	100	6.3	-0.2	126	513	81	80
44	5.899	0.130	0.081	1.84	90	-0.74	97	6.2	-0.1	125	510	81	79
45	6.038	0.139	0.082	1.84	90	-0.77	103	6.0	-0.2	125	504	81	79
46	6.171	0.133	0.078	1.85	91	-0.53	101	5.8	-0.2	125	499	82	80
47	6.306	0.135	0.084	1.84	91	-0.98	99	5.7	-0.1	124	493	82	79
48	6.442	0.136	0.082	1.87	91	-0.77	101	5.5	-0.2	124	490	82	80
49	6.577	0.135	0.084	1.84	92	-0.68	99	5.5	0	123	486	82	80
50	6.712	0.135	0.084	1.86	92	-0.8	99	5.3	-0.2	123	481	82	81
51	6.849	0.137	0.076	1.86	92	-0.85	105	5.1	-0.2	122	477	82	80
52	6.982	0.133	0.075	1.85	92	-0.81	103	5.1	0	122	472	82	79
53	7.120	0.138	0.082	1.86	93	-0.78	102	4.9	-0.2	121	466	82	81
54	7.255	0.135	0.088	1.87	93	-0.74	96	4.9	0	121	460	82	80
55	7.390	0.135	0.082	1.84	93	-0.82	99	4.8	-0.1	121	456	82	80
56	7.528	0.138	0.080	1.87	93	-0.69	103	4.7	-0.1	120	452	82	79
57	7.660	0.132	0.081	1.87	94	-0.81	98	4.6	-0.1	120	449	82	80
58	7.801	0.141	0.080	1.86	94	-0.85	105	4.5	-0.1	119	446	82	80
59	7.935	0.134	0.078	1.86	94	-0.62	101	4.4	-0.1	119	443	82	80
60	8.069	0.134	0.073	1.97	94	-0.46	104	4.3	-0.1	119	439	81	80
61	8.207	0.138	0.089	1.81	95	-0.84	97	4.2	-0.1	119	437	82	79
62	8.339	0.132	0.086	1.81	95	-0.7	94	4.1	-0.1	118	435	82	79
63	8.476	0.137	0.087	1.84	95	-0.49	97	4.0	-0.1	118	433	82	80

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF FireJob #: 20-606Model: Nova 2Tracking #: 74Run #: 2Technician: A KravitzDate: 6/11/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
64	8.611	0.135	0.080	1.85	95	-0.92	100	3.9	-0.1	118	430	82	80
65	8.745	0.134	0.078	1.84	96	-0.87	100	3.8	-0.1	117	428	82	80
66	8.882	0.137	0.086	1.86	96	-0.76	98	3.7	-0.1	117	426	82	80
67	9.016	0.134	0.084	1.85	96	-0.95	97	3.6	-0.1	117	423	81	79
68	9.150	0.134	0.077	1.85	96	-0.8	101	3.6	0	117	419	81	80
69	9.288	0.138	0.084	1.84	96	-1.01	99	3.5	-0.1	116	418	81	79
70	9.419	0.131	0.083	1.83	97	-0.58	95	3.4	-0.1	117	417	81	79
71	9.559	0.140	0.076	1.86	97	-0.59	106	3.3	-0.1	116	416	81	80
72	9.692	0.133	0.080	1.84	97	-0.68	98	3.3	0	116	414	81	80
73	9.827	0.135	0.081	1.87	97	-0.76	99	3.1	-0.2	115	413	81	79
74	9.965	0.138	0.079	1.85	97	-0.63	102	3.1	0	115	414	81	80
75	10.098	0.133	0.078	1.84	98	-0.97	99	3.0	-0.1	115	413	81	80
76	10.237	0.139	0.079	1.87	98	-0.83	103	2.9	-0.1	115	412	81	80
77	10.372	0.135	0.086	1.84	98	-0.76	96	2.8	-0.1	115	412	81	80
78	10.507	0.135	0.078	1.86	98	-0.79	101	2.8	0	115	411	81	80
79	10.644	0.137	0.082	1.81	98	-0.8	99	2.7	-0.1	114	410	81	80
80	10.779	0.135	0.082	1.86	98	-0.66	98	2.6	-0.1	114	409	81	80
81	10.916	0.137	0.073	1.85	99	-0.97	105	2.5	-0.1	114	408	81	79
82	11.052	0.136	0.083	1.84	99	-0.51	98	2.5	0	114	409	81	79
83	11.188	0.136	0.083	1.87	99	-0.94	98	2.4	-0.1	114	407	81	79
84	11.326	0.138	0.082	1.84	99	-0.93	100	2.3	-0.1	114	404	81	79
85	11.461	0.135	0.084	1.84	99	-0.72	97	2.3	0	113	401	81	79
86	11.596	0.135	0.086	1.82	99	-0.73	95	2.2	-0.1	113	401	81	80
87	11.735	0.139	0.084	1.84	99	-0.7	99	2.2	0	113	400	81	80
88	11.869	0.134	0.082	1.82	99	-0.75	97	2.1	-0.1	113	398	81	80
89	12.008	0.139	0.082	1.82	100	-0.87	100	2.0	-0.1	113	398	81	79
90	12.143	0.135	0.089	1.87	100	-0.7	94	1.9	-0.1	113	398	81	80
91	12.279	0.136	0.088	1.86	100	-0.98	95	1.9	0	113	398	81	80
92	12.418	0.139	0.078	1.84	100	-0.45	103	1.8	-0.1	113	397	81	79
93	12.552	0.134	0.078	1.82	100	-0.91	99	1.8	0	112	397	81	79
94	12.691	0.139	0.083	1.83	100	-0.82	100	1.7	-0.1	112	397	81	79
95	12.827	0.136	0.083	1.85	100	-0.8	98	1.6	-0.1	112	398	81	80

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 2

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/11/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
96	12.962	0.135	0.078	1.85	100	-0.96	100	1.6	0	112	397	81	79
97	13.102	0.140	0.085	1.85	100	-0.73	99	1.5	-0.1	112	395	81	80
98	13.236	0.134	0.081	1.82	101	-0.73	97	1.5	0	112	392	81	80
99	13.375	0.139	0.086	1.82	101	-0.69	98	1.4	-0.1	112	390	81	80
100	13.511	0.136	0.081	1.86	101	-0.87	99	1.3	-0.1	112	388	81	79
101	13.647	0.136	0.085	1.83	101	-0.88	96	1.3	0	111	387	81	80
102	13.787	0.140	0.080	1.82	101	-0.59	102	1.3	0	112	386	81	80
103	13.921	0.134	0.078	1.84	101	-0.8	99	1.2	-0.1	111	385	81	79
104	14.061	0.140	0.083	1.86	101	-0.72	100	1.2	0	111	383	81	80
105	14.197	0.136	0.089	1.85	101	-1.06	94	1.2	0	111	381	81	80
106	14.333	0.136	0.079	1.85	101	-0.78	100	1.1	-0.1	111	378	81	80
107	14.471	0.138	0.081	1.85	101	-0.76	100	1.0	-0.1	111	376	81	79
108	14.607	0.136	0.079	1.86	102	-0.84	99	1.0	0	110	374	81	80
109	14.746	0.139	0.078	1.87	102	-0.68	102	1.0	0	110	372	81	80
110	14.883	0.137	0.076	1.87	102	-0.91	102	1.0	0	110	370	81	80
111	15.020	0.137	0.081	1.86	102	-0.83	99	0.9	-0.1	109	369	81	79
112	15.157	0.137	0.082	1.88	102	-1.07	98	1.0	0.1	109	369	81	80
113	15.294	0.137	0.082	1.88	102	-0.77	98	0.8	-0.2	109	368	81	80
114	15.432	0.138	0.079	1.89	102	-0.59	101	0.8	0	109	366	81	81
115	15.569	0.137	0.083	1.87	102	-0.6	98	0.8	0	109	366	82	81
116	15.707	0.138	0.084	1.84	102	-0.75	98	0.8	0	109	365	81	80
117	15.844	0.137	0.081	1.86	102	-0.71	99	0.7	-0.1	109	364	81	79
118	15.981	0.137	0.083	1.88	102	-0.63	98	0.7	0	109	363	81	80
119	16.121	0.140	0.085	1.87	102	-0.75	99	0.7	0	109	361	81	80
120	16.255	0.134	0.075	1.85	102	-0.95	100	0.6	-0.1	108	361	81	80
121	16.395	0.140	0.077	1.88	103	-0.62	103	0.5	-0.1	108	361	82	81
122	16.531	0.136	0.080	1.86	103	-0.88	98	0.4	-0.1	108	362	81	80
123	16.668	0.137	0.076	1.87	103	-0.99	102	0.5	0.1	108	362	81	79
124	16.809	0.141	0.074	1.85	103	-0.69	106	0.5	0	108	360	81	80
125	16.943	0.134	0.079	1.84	103	-0.92	98	0.5	0	108	359	81	79
126	17.084	0.141	0.079	1.88	103	-0.85	103	0.4	-0.1	108	358	81	80
127	17.220	0.136	0.084	1.87	103	-0.72	96	0.3	-0.1	108	358	81	80

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire Job #: 20-606
 Model: Nova 2 Tracking #: 74
 Run #: 2 Technician: A Kravitz
 Date: 6/11/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
128	17.357	0.137	0.082	1.87	103	-0.92	98	0.3	0	108	358	81	80
129	17.497	0.140	0.078	1.86	103	-0.99	103	0.3	0	108	357	81	80
130	17.632	0.135	0.077	1.86	103	-0.5	100	0.1	-0.2	108	355	81	80
131	17.772	0.140	0.081	1.87	103	-0.75	101	0.2	0.1	108	355	81	80
132	17.909	0.137	0.087	1.89	103	-0.89	95	0.2	0	107	354	81	80
133	18.046	0.137	0.082	1.87	103	-0.47	98	0.1	-0.1	108	353	81	80
134	18.185	0.139	0.084	1.88	103	-0.9	98	0.1	0	108	352	81	80
135	18.321	0.136	0.075	1.88	103	-0.71	102	0.1	0	107	353	81	81
136	18.461	0.140	0.081	1.88	103	-0.84	101	0.0	-0.1	107	354	81	80
Avg/Tot	18.461	0.136	0.081	1.84	94	-0.79	100			119	437	81	79.3

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 2

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/11/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
0	0.000		0.00	79	-1		79	0.000	7.63	0.04
1	0.126	0.126	1.83	79	0	99	80	-0.070	4.14	0.07
2	0.257	0.131	1.86	79	0	105	81	-0.080	2.66	0.11
3	0.390	0.133	1.84	79	0	99	83	-0.090	3.37	0.12
4	0.522	0.132	1.85	79	0	102	81	-0.080	7.85	0.15
5	0.654	0.132	1.85	79	-0.16	100	81	-0.070	10.16	0.37
6	0.787	0.133	1.83	79	-0.41	106	82	-0.080	7.83	0.17
7	0.919	0.132	1.84	79	-1.6	102	82	-0.080	8.27	0.11
8	1.049	0.130	1.82	80	0	98	82	-0.080	13.10	0.46
9	1.184	0.135	1.84	80	0	102	82	-0.080	14.41	0.94
10	1.315	0.131	1.84	80	-2.53	99	82	-0.080	14.60	1.15
11	1.446	0.131	1.84	80	-0.38	100	82	-0.080	14.70	1.46
12	1.581	0.135	1.84	80	-0.32	103	82	-0.080	14.09	0.70
13	1.711	0.130	1.85	81	0	100	82	-0.080	13.89	0.41
14	1.844	0.133	1.85	81	0	98	82	-0.090	14.31	0.60
15	1.977	0.133	1.85	81	-1.85	101	82	-0.090	14.60	0.80
16	2.108	0.131	1.84	81	-0.51	101	82	-0.090	14.69	0.89
17	2.244	0.136	1.86	82	-2.97	104	82	-0.090	14.89	1.03
18	2.375	0.131	1.84	82	0	97	82	-0.090	15.15	1.31
19	2.507	0.132	1.85	82	-2.48	102	82	-0.090	15.02	1.26
20	2.642	0.135	1.85	83	-2.38	107	82	-0.080	15.06	1.16
21	2.774	0.132	1.86	83	-2.05	106	82	-0.080	15.05	1.31
22	2.906	0.132	1.85	83	-2.79	100	82	-0.090	15.09	1.41
23	3.041	0.135	1.86	84	-0.17	104	82	-0.080	15.26	1.51
24	3.173	0.132	1.85	84	-1.18	105	82	-0.080	15.25	1.64
25	3.306	0.133	1.85	84	-0.34	102	82	-0.090	15.31	1.73
26	3.442	0.136	1.86	85	-3.44	102	82	-0.090	15.32	1.77
27	3.572	0.130	1.85	85	-1.41	98	82	-0.090	15.25	1.79
28	3.708	0.136	1.85	85	-3.35	105	82	-0.080	15.35	1.85
29	3.841	0.133	1.86	86	-3.21	97	82	-0.090	15.51	1.93
30	3.974	0.133	1.87	86	-0.72	98	82	-0.080	15.57	1.98
31	4.109	0.135	1.86	87	-0.01	101	82	-0.090	15.57	2.12

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 2

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/11/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
32	4.243	0.134	1.85	87	-3.19	98	82	-0.080	15.56	2.20
33	4.376	0.133	1.84	87	-3.15	99	82	-0.080	15.46	2.25
34	4.512	0.136	1.87	88	-3.27	102	82	-0.080	15.47	2.13
35	4.644	0.132	1.87	88	-0.5	99	82	-0.090	15.27	1.40
36	4.779	0.135	1.87	88	-3.09	104	82	-0.080	15.19	0.77
37	4.914	0.135	1.87	89	-2.61	103	81	-0.070	14.93	0.34
38	5.047	0.133	1.86	89	-3.3	97	81	-0.090	14.71	0.28
39	5.183	0.136	1.86	89	-1.37	101	81	-0.080	14.79	0.35
40	5.317	0.134	1.86	89	-3.39	104	81	-0.080	14.97	0.55
41	5.450	0.133	1.86	90	-1.78	99	82	-0.070	15.21	0.72
42	5.586	0.136	1.86	90	-3.03	104	82	-0.080	15.10	0.77
43	5.719	0.133	1.87	91	-0.03	98	82	-0.090	15.06	0.56
44	5.854	0.135	1.87	91	-2.85	101	82	-0.080	14.79	0.35
45	5.989	0.135	1.86	91	-0.38	101	82	-0.080	14.47	0.18
46	6.122	0.133	1.86	92	-3.25	102	82	-0.080	13.99	0.11
47	6.259	0.137	1.85	92	-3.32	101	82	-0.080	13.58	0.05
48	6.393	0.134	1.86	92	0	100	82	-0.080	13.16	0.06
49	6.526	0.133	1.86	92	-3.12	98	82	-0.090	13.00	0.03
50	6.664	0.138	1.87	93	-0.5	101	82	-0.070	12.86	0.02
51	6.796	0.132	1.87	93	-0.47	102	82	-0.080	12.50	0.01
52	6.934	0.138	1.85	93	-0.64	107	82	-0.080	12.17	0.00
53	7.068	0.134	1.86	94	0	99	82	-0.070	11.88	0.00
54	7.203	0.135	1.87	94	-2.71	97	82	-0.070	11.53	0.01
55	7.339	0.136	1.86	94	-0.15	101	82	-0.070	11.25	0.00
56	7.474	0.135	1.87	95	-0.68	101	82	-0.080	11.09	0.00
57	7.609	0.135	1.86	95	-0.7	100	82	-0.080	10.86	0.01
58	7.745	0.136	1.88	95	-0.43	102	82	-0.070	10.74	0.00
59	7.880	0.135	1.87	95	-0.06	102	82	-0.080	10.67	0.00
60	8.016	0.136	1.84	96	-0.25	106	82	-0.080	10.63	0.00
61	8.151	0.135	1.86	96	-0.12	95	82	-0.080	10.47	0.00
62	8.285	0.134	1.86	96	0	96	82	-0.060	10.54	0.01
63	8.422	0.137	1.85	96	-0.36	98	82	-0.080	10.42	0.01

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 2

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/11/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
64	8.555	0.133	1.86	97	-3.34	99	82	-0.080	10.29	0.01
65	8.692	0.137	1.86	97	-3.38	103	82	-0.070	10.09	0.00
66	8.826	0.134	1.84	97	-0.9	96	82	-0.070	9.97	0.01
67	8.961	0.135	1.86	97	-3.23	98	82	-0.070	9.85	0.00
68	9.097	0.136	1.85	98	-1.83	103	82	-0.070	9.83	0.01
69	9.232	0.135	1.84	98	-2.57	98	82	-0.070	9.78	0.02
70	9.368	0.136	1.86	98	-0.16	99	82	-0.060	9.65	0.00
71	9.504	0.136	1.87	98	-0.41	103	82	-0.080	9.74	0.01
72	9.638	0.134	1.85	98	-3.18	99	82	-0.080	9.69	0.00
73	9.775	0.137	1.85	99	-0.4	101	82	-0.070	9.75	0.01
74	9.910	0.135	1.86	99	-3.31	100	82	-0.070	9.78	0.00
75	10.045	0.135	1.85	99	-1.98	101	82	-0.070	9.81	0.00
76	10.183	0.138	1.87	99	-0.48	103	82	-0.070	9.75	0.02
77	10.316	0.133	1.86	99	-1.7	95	82	-0.070	9.74	0.00
78	10.455	0.139	1.86	100	-0.48	104	82	-0.070	9.75	0.03
79	10.589	0.134	1.86	100	-3.41	98	82	-0.070	9.72	0.00
80	10.724	0.135	1.87	100	-1.86	98	82	-0.070	9.68	0.03
81	10.862	0.138	1.87	100	-1.03	107	82	-0.070	9.52	0.02
82	10.996	0.134	1.85	101	0	97	82	-0.070	9.55	0.02
83	11.133	0.137	1.87	101	-0.16	99	82	-0.080	9.40	0.03
84	11.269	0.136	1.86	101	-3.3	99	82	-0.070	9.19	0.04
85	11.404	0.135	1.84	101	-2.51	97	82	-0.060	8.79	0.02
86	11.541	0.137	1.85	101	-3.36	97	82	-0.070	8.74	0.03
87	11.677	0.136	1.86	101	-0.07	98	82	-0.070	8.57	0.03
88	11.812	0.135	1.86	101	-0.06	98	82	-0.080	8.60	0.03
89	11.949	0.137	1.86	102	-1.73	99	82	-0.070	8.74	0.01
90	12.084	0.135	1.85	102	0	94	82	-0.070	8.72	0.05
91	12.222	0.138	1.87	102	-3.25	97	82	-0.070	8.67	0.05
92	12.358	0.136	1.85	102	-3.04	101	82	-0.070	8.66	0.02
93	12.492	0.134	1.87	102	-3.27	100	82	-0.070	8.96	0.02
94	12.631	0.139	1.86	102	-2.59	100	82	-0.070	8.98	0.04
95	12.765	0.134	1.86	102	-3.15	96	82	-0.060	9.12	0.02

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 2

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/11/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
96	12.903	0.138	1.85	102	-3.47	103	82	-0.070	9.13	0.02
97	13.039	0.136	1.87	103	-3.27	97	82	-0.070	8.63	0.03
98	13.174	0.135	1.86	103	-0.9	98	82	-0.060	8.19	0.03
99	13.313	0.139	1.86	103	-2.65	98	82	-0.060	7.90	0.04
100	13.446	0.133	1.86	103	-3.29	97	82	-0.070	7.75	0.06
101	13.585	0.139	1.87	103	-3.36	99	82	-0.070	7.72	0.05
102	13.721	0.136	1.88	103	0	100	82	-0.070	7.57	0.04
103	13.856	0.135	1.87	103	-3.22	100	82	-0.060	7.48	0.06
104	13.995	0.139	1.86	103	-3.17	100	82	-0.070	7.43	0.07
105	14.128	0.133	1.86	104	0	92	82	-0.060	7.41	0.07
106	14.267	0.139	1.86	104	-0.46	102	82	-0.070	7.41	0.05
107	14.403	0.136	1.88	104	-3.3	99	82	-0.060	7.24	0.07
108	14.537	0.134	1.87	104	-3.2	98	82	-0.070	6.97	0.06
109	14.677	0.140	1.86	104	-0.08	103	82	-0.060	6.95	0.06
110	14.811	0.134	1.87	104	-0.01	100	82	-0.070	6.97	0.07
111	14.950	0.139	1.88	104	-2.02	101	82	-0.060	7.13	0.07
112	15.086	0.136	1.86	104	0	98	82	-0.060	7.10	0.07
113	15.221	0.135	1.87	104	-1.96	97	82	-0.070	7.20	0.03
114	15.360	0.139	1.86	105	-1.13	102	82	-0.070	7.14	0.05
115	15.494	0.134	1.86	105	-0.18	96	82	-0.060	7.17	0.07
116	15.633	0.139	1.85	105	-3.35	99	82	-0.070	7.17	0.06
117	15.769	0.136	1.87	105	-0.4	98	82	-0.070	7.18	0.08
118	15.904	0.135	1.87	105	-1.26	96	82	-0.060	7.21	0.06
119	16.044	0.140	1.87	105	-1.14	99	82	-0.060	7.17	0.06
120	16.178	0.134	1.87	105	-3.08	101	82	-0.050	7.11	0.08
121	16.317	0.139	1.86	105	-0.44	103	82	-0.070	7.09	0.08
122	16.452	0.135	1.86	105	-3.36	98	82	-0.070	7.20	0.06
123	16.588	0.136	1.87	105	-2.06	101	82	-0.070	7.19	0.06
124	16.728	0.140	1.86	105	-0.55	106	82	-0.060	7.19	0.06
125	16.862	0.134	1.87	105	-1.57	98	82	-0.060	7.21	0.07
126	17.000	0.138	1.85	105	-3.3	101	82	-0.070	7.22	0.08
127	17.137	0.137	1.86	105	-0.62	97	82	-0.070	7.17	0.07

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF FireJob #: 20-606Model: Nova 2Tracking #: 74Run #: 2Technician: A KravitzDate: 6/11/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
128	17.273	0.136	1.87	106	-2.19	97	82	-0.070	7.18	0.06
129	17.412	0.139	1.86	106	0	102	82	-0.070	7.31	0.07
130	17.546	0.134	1.87	106	-3.36	99	82	-0.070	7.03	0.05
131	17.684	0.138	1.87	106	-1.34	100	82	-0.070	7.00	0.06
132	17.821	0.137	1.86	106	-1.78	95	82	-0.060	7.01	0.08
133	17.957	0.136	1.86	106	0	97	82	-0.070	6.93	0.05
134	18.096	0.139	1.85	106	0	98	82	-0.070	6.91	0.06
135	18.231	0.135	1.88	106	-3.33	101	82	-0.060	6.88	0.07
136	18.369	0.138	1.86	106	-0.73	99	82	-0.060	6.85	0.06
Avg/Tot	18.369	0.135	1.84	95	-1.56	100	82	-0.073	10.45	0.35

WOODSTOVE SURFACE TEMPERATURE DATA

Client: MF Fire
 Model: Nova 2
 Run #: 2

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/11/2020

Stove ΔT: 12

Elapsed Time (min)	Temperature Data (°F)						Stove Surface Average	Catalyst Exit
	FB Left	FB Right	FB Back	FB Top	FB Bottom			
0	344	287	191	528	289	327.8	536	
1	343	287	191	494	290	321.0	443	
2	343	287	192	472	290	316.8	505	
3	343	290	192	501	291	323.4	862	
4	342	288	192	499	292	322.6	904	
5	342	293	194	488	293	322.0	829	
6	341	293	194	499	294	324.2	889	
7	340	292	195	541	294	332.4	1045	
8	339	294	195	574	295	339.4	1086	
9	337	289	195	600	294	343.0	1096	
10	335	289	193	625	295	347.4	1111	
11	334	292	193	644	295	351.6	1091	
12	333	290	192	657	295	353.4	1106	
13	332	290	192	669	295	355.6	1114	
14	331	291	192	681	295	358.0	1114	
15	331	288	191	693	294	359.4	1113	
16	330	286	191	700	294	360.2	1115	
17	330	287	190	706	295	361.6	1118	
18	329	287	190	714	295	363.0	1121	
19	329	286	189	719	295	363.6	1118	
20	329	286	189	724	295	364.6	1119	
21	330	280	190	726	295	364.2	1119	
22	330	285	189	730	294	365.6	1118	
23	331	287	189	730	295	366.4	1115	
24	332	288	189	730	295	366.8	1110	
25	332	285	189	728	294	365.6	1109	
26	333	289	190	728	295	367.0	1105	
27	334	287	190	727	295	366.6	1100	
28	334	289	190	727	295	367.0	1098	
29	336	286	190	725	295	366.4	1090	
30	337	293	192	723	295	368.0	1087	
31	338	290	191	722	295	367.2	1085	
32	339	293	193	723	295	368.6	1087	
33	339	291	193	731	294	369.6	1094	
34	340	295	194	743	294	373.2	1148	
35	342	296	195	755	294	376.4	1148	
36	343	295	195	762	295	378.0	1131	
37	345	300	197	767	295	380.8	1110	
38	347	299	197	769	295	381.4	1113	
39	348	300	197	773	294	382.4	1116	
40	350	299	199	774	296	383.6	1122	
41	350	302	198	776	296	384.4	1122	
42	352	305	200	775	296	385.6	1120	
43	354	305	199	776	296	386.0	1109	
44	354	305	200	773	296	385.6	1096	
45	354	307	200	766	297	384.8	1077	
46	355	305	201	756	297	382.8	1057	
47	357	308	202	747	297	382.2	1046	

WOODSTOVE SURFACE TEMPERATURE DATA

Client: MF Fire
 Model: Nova 2
 Run #: 2

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/11/2020

Stove ΔT: 12

Elapsed Time (min)	Temperature Data (°F)						Stove Surface Average	Catalyst Exit
	FB Left	FB Right	FB Back	FB Top	FB Bottom			
48	359	312	202	736	297	381.2	1036	
49	360	315	204	726	297	380.4	1024	
50	361	310	204	717	297	377.8	1012	
51	361	313	204	705	297	376.0	995	
52	362	314	204	696	297	374.6	976	
53	364	317	205	683	297	373.2	965	
54	364	318	205	672	298	371.4	956	
55	366	319	206	663	297	370.2	947	
56	367	319	206	652	297	368.2	938	
57	366	318	207	643	297	366.2	931	
58	367	323	207	635	298	366.0	926	
59	368	323	209	627	298	365.0	921	
60	369	323	208	620	297	363.4	917	
61	369	324	209	612	298	362.4	909	
62	368	323	208	606	298	360.6	901	
63	369	322	211	600	299	360.2	894	
64	369	322	209	592	299	358.2	883	
65	370	327	212	585	299	358.6	878	
66	370	322	212	578	299	356.2	868	
67	370	329	211	573	300	356.6	862	
68	370	325	211	569	300	355.0	857	
69	370	328	212	564	300	354.8	855	
70	370	328	213	562	301	354.8	856	
71	371	329	213	559	302	354.8	858	
72	369	327	212	557	302	353.4	860	
73	368	325	212	556	302	352.6	857	
74	368	328	212	557	302	353.4	857	
75	368	328	212	555	302	353.0	854	
76	368	327	212	554	302	352.6	852	
77	368	324	213	553	302	352.0	853	
78	367	322	211	551	302	350.6	850	
79	367	325	212	550	302	351.2	846	
80	366	324	211	547	302	350.0	840	
81	366	326	212	546	302	350.4	840	
82	365	327	213	544	302	350.2	839	
83	364	325	212	541	302	348.8	832	
84	365	326	212	538	302	348.6	812	
85	364	324	212	536	302	347.6	803	
86	364	323	212	534	302	347.0	800	
87	364	326	213	532	302	347.4	798	
88	364	322	213	531	302	346.4	796	
89	364	323	214	529	302	346.4	795	
90	364	326	214	526	303	346.6	794	
91	364	324	213	523	302	345.2	794	
92	362	319	213	523	301	343.6	798	
93	363	323	213	521	301	344.2	801	
94	362	323	213	520	301	343.8	804	
95	362	322	213	519	301	343.4	803	

WOODSTOVE SURFACE TEMPERATURE DATA

Client: MF Fire
 Model: Nova 2
 Run #: 2

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/11/2020

Stove ΔT: 12

Temperature Data (°F)							
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
96	361	320	213	515	302	342.2	798
97	361	324	214	511	302	342.4	794
98	361	324	214	507	302	341.6	789
99	361	320	214	502	302	339.8	785
100	361	322	215	495	303	339.2	786
101	360	321	216	488	303	337.6	789
102	361	323	215	483	303	337.0	786
103	360	322	214	480	304	336.0	781
104	359	321	214	475	304	334.6	777
105	359	321	215	471	303	333.8	772
106	358	320	214	467	304	332.6	767
107	358	320	215	462	304	331.8	759
108	358	318	215	458	305	330.8	754
109	358	319	214	456	304	330.2	749
110	356	318	214	453	305	329.2	747
111	355	315	213	450	305	327.6	745
112	354	316	214	447	306	327.4	743
113	354	318	214	445	306	327.4	741
114	354	313	212	442	306	325.4	740
115	353	297	214	440	306	322.0	739
116	352	310	213	440	306	324.2	738
117	351	313	213	437	306	324.0	735
118	350	309	212	437	307	323.0	728
119	349	306	213	434	307	321.8	726
120	349	310	213	435	307	322.8	725
121	348	286	214	432	307	317.4	727
122	347	304	214	431	307	320.6	725
123	347	305	212	430	307	320.2	724
124	346	305	212	429	307	319.8	723
125	346	308	213	429	308	320.8	722
126	344	305	213	429	308	319.8	722
127	344	306	212	428	308	319.6	722
128	344	305	212	427	308	319.2	723
129	344	305	213	426	308	319.2	720
130	343	301	212	424	308	317.6	718
131	342	302	213	424	309	318.0	717
132	342	304	214	422	308	318.0	717
133	342	301	213	421	308	317.0	717
134	341	303	214	420	309	317.4	715
135	340	303	214	420	309	317.2	714
136	340	300	213	418	309	316.0	713
Average	352	309	205	580	300	349	896

LAB SAMPLE DATA - ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 2

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/11/2020

	Sample ID	Tare, mg	Total, mg	Final, mg	Catch, mg
Train A Filters - First Hour	A014	120.6	120.6	123.0	2.4
Train A Filters - Remainder	A015	120.5	240.5	240.7	0.2
	A016	120.0			
Train A Probe	10A	116819.7	116819.7	116820.3	0.6
Train A O-Rings	10A	3426.8	3426.8	3428.1	1.3
Train B Filters	A017	119.8	241.2	243.4	2.2
	A018	121.4			
Train B Probe	10B	117903.5	117903.5	117904.7	1.2
Train B O-Rings	10B	3568.6	3568.6	3569.6	1.0
Background Filter			0.0	0.0	

Placed in Dessicator on:

Train A Filters - First Hour	123.0	6/29 9:24	123.0	6/30 10:15		
Train A Filters - Remainder	240.9	6/29 9:24	240.7	6/30 10:16		
Train A Probe	116820.5	6/29 9:14	116820.3	6/30 10:12		
Train A O-Rings	3428.1	6/29 9:19	3428.1	6/30 10:14		
Train B Filters	243.3	6/29 9:25	243.4	6/30 10:16		
Train B Probe	117904.6	6/29 9:38	117904.7	6/30 10:12		
Train B O-Rings	3569.5	6/29 9:19	3569.6	6/30 10:15		
Background Filter						

1st hour Sub-Total, mg:	2.4
Remainder Sub-Total, mg:	2.1
Train 1 Aggregate, mg:	4.5
Train 2 Aggregate, mg:	4.4
Ambient Aggregate, mg:	0.0

Form P407 ASTM E2780 Run Notes

Client: MF Fire Job Number: 20-606 Tracking #: 74
 Model: Nova 2 Run Number: 2 Test Date: 6/11/20

Test Control Settings

Primary Air Setting(s): N/A - Fixed
 Targeted Burn Category: N/A - Single BR

Preburn Notes

Time	Notes
	-None-

Test Notes

Test Burn Start Time: 14:30 Test Fuel Loaded by: 50 seconds
 Door Closed: 2:15 seconds Air Control Set at: N/A seconds
 Other Loading Notes: Fan on high

Time	Notes
60:00	Changed filter A

Test Burn End Time: 16:47

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO₂ (%): 16.90 CO (%): 4.18
 Mid Gas CO₂ (%): 10.00 CO (%): 2.51

Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	11:48	11:53	11:51	6/12 8:35	6/12 8:42	6/12 8:38
CO ₂	0.00	9.96	16.90	-0.01	9.87	16.86
CO	0.000	2.427	4.180	-0.001	2.418	4.177

Flue Gas Probe Leak Check: Initial: No Leakage Final: No Leakage

Technician Signature: 

Date: 7/1/2020

Form P407 ASTM E2780 Run Notes

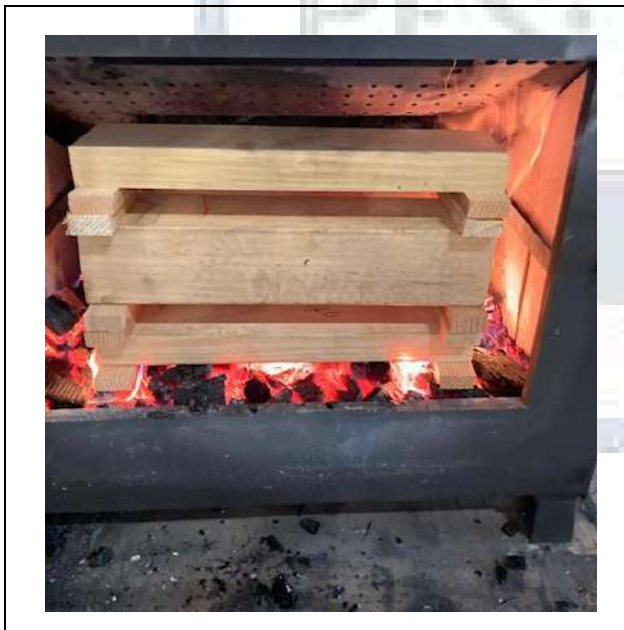
Client: MF Fire Job Number: 20-606 Tracking #: 74
Model: Nova 2 Run Number: 2 Test Date: 6/11/20



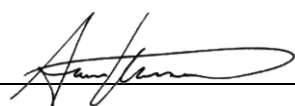
Test Fuel Front View



Test Fuel Iso View



Test Fuel Loaded in Stove

Technician Signature: 

Date: 7/1/2020

**WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515**



Run 3 Data Summary

Client:	MF Fire
Model:	Nova 2
Job #:	20-606
Tracking #:	74
Test Date:	6/16/2020



Technician Signature

7/1/2020

Date

TEST RESULTS - ASTM E2780 / ASTM E2515

Client: MF Fire

Model: Nova 2

Run #: 3

Job #: 20-606

Tracking #: 74

Technician: A Kravitz

Date: 6/16/2020

Burn Rate (kg/hr):	2.23
---------------------------	-------------

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft ³)	0.000	21.714	21.532	7.960
Average Gas Velocity in Dilution Tunnel (ft/sec)	15.7			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	10131.9			
Average Gas Meter Temperature (°F)	69.2	87.6	91.4	78.7
Total Sample Volume (dscf)	0.000	21.040	20.800	7.839
Average Tunnel Temperature (°F)	106.5			
Total Time of Test (min)	163			
Total Particulate Catch (mg)	0.0	5.0	3.6	3.1
Particulate Concentration, dry-standard (g/dscf)	0.0000000	0.0002376	0.0001731	0.0003954
Total PM Emissions (g)	0.00	6.54	4.76	4.01
Particulate Emission Rate (g/hr)	0.00	2.41	1.75	4.01
Emissions Factor (g/kg)	-	1.08	0.79	-
Difference from Average Total Particulate Emissions (g)	-	0.89	0.89	-
Difference from Average Emissions Factor (g/kg)	-	0.15	0.15	-

Final Average Results	
Total Particulate Emissions (g)	5.65
Particulate Emission Rate (g/hr)	2.08
Emissions Factor (g/kg)	0.93
HHV Efficiency (%)	75.1%
LHV Efficiency (%)	81.2%
CO Emissions (g/min)	0.57

Quality Checks	Requirement	Observed	Result
Dual Train Precision	Each train within 7.5% of average emissions (in grams), or emission factors within 0.5 g/kg	See Above	OK
Filter Temps	<90 °F	75.0	OK
Face Velocity	< 30 ft/min	7.4	OK
Leakage Rate	Less than 4% of average sample rate	0 cfm	OK
Ambient Temp	55-90 °F	Min: 68 / Max: 71	OK
Negative Probe Weight Evaluation	<5% of Total Catch	Probe Catch Not Negative	OK
Pro-Rate Variation	90% of readings between 90-110%; none greater than 120% or less than 80%	See Data Tabs	OK
Stove Surface ΔT	<126°F	0.0	OK

B415.1 Efficiency Results

Manufacturer: MF Fire
Model: Nova 2
Date: 06/16/20
Run: 3
Control #: 20-606
Test Duration: 163
Output Category: 4

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	75.1%	81.2%
Combustion Efficiency	99.2%	99.2%
Heat Transfer Efficiency	75.7%	81.8%

Output Rate (kJ/h)	33,237	31,529	(Btu/h)
Burn Rate (kg/h)	2.23	4.92	(lb/h)
Input (kJ/h)	44,257	41,983	(Btu/h)

Test Load Weight (dry kg)	6.07	13.38	dry lb
MC wet (%)	17.43		
MC dry (%)	21.11		
Particulate (g)	5.65		
CO (g)	93		
Test Duration (h)	2.72		

Emissions	Particulate	CO
g/MJ Output	0.06	1.03
g/kg Dry Fuel	0.93	15.39
g/h	2.08	34.38
g/min	0.03	0.57
lb/MM Btu Output	0.15	2.40

Air/Fuel Ratio (A/F)	12.67
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VERSION:

2.2

12/14/2009

WOODSTOVE FUEL DATA - ASTM E2780

Client: MF Fire
 Model: Nova 2
 Run #: 3

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/16/2020

Preburn Fuel Information						
Size	Length (in)	Moisture Content (% DB)		Size	Length (in)	Moisture Content (% DB)
2x4	16.00	19.0		2x4	10.00	21.0
2x4	16.00	24.0		2x4	10.00	21.0
2x4	16.00	23.0		2x4	10.00	22.0
2x4	16.00	22.0				
2x4	10.00	22.0				
2x4	10.00	26.0				
2x4	10.00	19.0				
2x4	10.00	18.0				
Total Fuel Weight (lbs):		14.6	Average Moisture (%DB):		21.5	

Firebox Volume (ft³): 2.40
 Total 2x4 Crib Weight, with spacers (lbs): 6.81
 Total 4x4 Crib Weight, with spacers (lbs): 9.36
 Total Wet Fuel Weight, with spacers (lbs): 16.16

Coal Bed Range (20-25%):
 Min (lbs): 3.23
 Max (lbs): 4.04

Test Fuel Information						
Size	Length (in)	Weight (lbs)	Moisture Content (%DB)			Dry Weight (lbs)
4x4	16.00	4.46	21.7	21.4	21.9	3.67
4x4	16.00	4.15	24.7	21.4	23.1	3.37
2x4	16.00	1.97	18.8	19.7	19.5	1.65
2x4	16.00	1.83	20.0	19.1	19.9	1.53
2x4	16.00	1.71	21.1	22.4	21.9	1.40
Total Dry Weight, no spacers (lbs):						11.62
Total Dry Weight, with spacers (lbs):						13.37

Spacer Moisture Readings (%DB)						
16.5						

Quality Checks	Requirement	Observed	Result
Fuel Density	25 - 36 (lbs/ft ³ , DB)	31.2	OK
Loading Density	6.3 - 7.7 (lbs/ft ³ , WB)	6.73	OK
2x4 Fuel Mix	35 - 65 % of total weight	42%	OK

DILUTION TUNNEL & MISC. DATA - ASTM E2780 / E2515

Client: MF Fire
 Model: Nova 2
 Run #: 3
 Test Start Time:

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/16/2020

Total Sampling Time (min): 163
 Recording Interval (min): 1

Meter Box γ Factor: 0.998 (A)
 Meter Box γ Factor: 1.002 (B)
 Meter Box γ Factor: 1.000 (Ambient)

Induced Draft Check (in. H₂O): 0
 Smoke Capture Check (%): 100%
 Date Flue Pipe Last Cleaned: 6/4/2020

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	30.02	29.99	30.01
Relative Humidity (%)	51.7	40.0	
Room Air Velocity (ft/min)	0	0	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:			ft ³

Sample Train Post-Test Leak Checks

(A) cfm @ in. Hg
 (B) cfm @ in. Hg
 (Ambient) cfm @ in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H ₂ O)	Temp (°F)
1	0.032	105
2	0.060	105
3	0.066	105
4	0.042	105
5	0.040	105
6	0.062	105
7	0.062	105
8	0.034	105
Center	0.082	105

Dilution Tunnel H₂O: 2.00 percent
 Tunnel Diameter: 6 inches
 Pitot Tube Cp: 0.99 [unitless]
 Dilution Tunnel MW(dry): 29.00 lb/lb-mole
 Dilution Tunnel MW(wet): 28.78 lb/lb-mole
 Tunnel Area: 0.1963 ft²

V_{strav} : 15.63 ft/sec
 V_{scent} : 19.60 ft/sec
 F_p : 0.797 [ratio]
 Initial Tunnel Flow: 163.7 scf/min

Static Pressure: -0.180 in. H₂O

TEST FUEL PROPERTIES

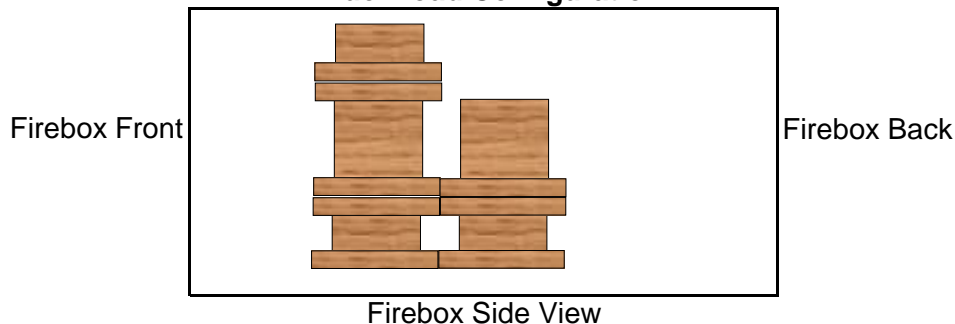
Default Fuel Values

Fuel Type:	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

Actual Fuel Used Properties

Fuel Type:	D. Fir
HHV (kJ/kg)	19,810
%C	48.73
%H	6.87
%O	43.9
%Ash	0.5
MC (%DB)	21.1

Fuel Load Configuration



WOODSTOVE PREBURN DATA - ASTM E2780

Client: MF Fire
 Model: Nova 2
 Run #: 3

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/16/2020

Recording Interval (min): 1
 Run Time (min): 122

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	Temperatures (°F)							Flue	Ambient
			FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average			
0	3.7	-0.078	295	260	252	606	166	315.8	404	67	
1	14.4	-0.075	296	260	255	593	167	314.2	418	67	
2	17.6	-0.075	297	261	257	578	169	312.4	399	67	
3	17.4	-0.082	298	263	259	562	171	310.6	404	67	
4	17.4	-0.081	299	264	261	548	172	308.8	406	66	
5	17.3	-0.079	299	265	262	537	175	307.6	404	67	
6	17.3	-0.075	299	265	250	516	176	301.2	402	67	
7	17.1	-0.075	299	265	243	499	177	296.6	413	67	
8	17.0	-0.069	299	267	233	486	179	292.8	396	67	
9	16.9	-0.077	298	267	225	486	180	291.2	399	67	
10	16.8	-0.085	297	267	217	479	181	288.2	403	66	
11	16.7	-0.071	296	267	211	468	182	284.8	416	67	
12	16.4	-0.080	295	265	204	470	183	283.4	434	67	
13	16.3	-0.079	294	264	198	469	183	281.6	418	67	
14	16.3	-0.081	292	262	195	461	184	278.8	407	67	
15	16.0	-0.079	291	263	190	451	185	276.0	399	66	
16	16.0	-0.073	290	261	186	440	185	272.4	390	66	
17	15.9	-0.075	289	260	183	430	185	269.4	385	67	
18	15.7	-0.077	288	260	180	422	186	267.2	384	66	
19	15.6	-0.075	287	258	177	417	186	265.0	385	66	
20	15.5	-0.073	285	257	174	413	187	263.2	383	66	
21	15.3	-0.076	284	255	172	410	187	261.6	382	67	
22	15.3	-0.079	283	254	170	409	187	260.6	384	66	
23	15.1	-0.074	283	253	168	409	188	260.2	386	66	
24	14.9	-0.079	282	249	166	404	188	257.8	411	67	
25	14.5	-0.086	281	250	165	415	189	260.0	444	67	
26	14.3	-0.087	281	247	163	447	189	265.4	494	68	
27	14.2	-0.079	280	246	162	462	190	268.0	460	67	
28	14.0	-0.081	280	246	162	464	190	268.4	441	67	
29	13.9	-0.079	280	245	161	462	190	267.6	430	67	
30	13.7	-0.083	279	245	160	458	191	266.6	420	67	
31	13.6	-0.079	279	245	160	453	192	265.8	415	67	
32	13.5	-0.083	280	245	160	446	192	264.6	413	67	
33	13.3	-0.081	279	244	159	441	192	263.0	413	67	
34	13.2	-0.071	279	244	158	435	193	261.8	407	67	
35	13.1	-0.066	279	242	158	430	193	260.4	403	67	
36	13.0	-0.078	279	243	157	427	194	260.0	400	67	
37	12.9	-0.073	279	243	156	428	194	260.0	396	67	
38	12.7	-0.065	279	241	156	432	195	260.6	394	67	
39	12.6	-0.078	278	240	155	435	196	260.8	394	67	
40	12.5	-0.076	278	241	154	437	196	261.2	394	67	
41	12.4	-0.071	277	240	154	440	196	261.4	395	67	
42	12.3	-0.080	277	240	153	442	197	261.8	394	67	
43	12.1	-0.078	276	241	153	443	197	262.0	394	68	
44	12.0	-0.078	276	239	152	445	197	261.8	393	68	

WOODSTOVE PREBURN DATA - ASTM E2780

Client: MF Fire
 Model: Nova 2
 Run #: 3

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/16/2020

Recording Interval (min): 1
 Run Time (min): 122

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	Temperatures (°F)							Flue	Ambient
			FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average			
45	11.9	-0.080	275	238	151	449	197	262.0	391	67	
46	11.6	-0.068	275	240	151	453	198	263.4	390	67	
47	11.6	-0.071	274	238	150	455	198	263.0	389	68	
48	11.5	-0.070	274	239	150	460	198	264.2	389	68	
49	11.4	-0.070	273	240	151	467	199	266.0	392	68	
50	11.1	-0.079	273	241	150	475	198	267.4	396	67	
51	10.9	-0.079	273	241	151	484	199	269.6	399	68	
52	10.8	-0.083	273	241	151	494	199	271.6	403	68	
53	10.7	-0.073	273	241	150	501	199	272.8	407	68	
54	10.6	-0.073	273	243	151	509	199	275.0	408	68	
55	10.4	-0.072	273	242	151	517	200	276.6	409	68	
56	10.3	-0.079	273	243	152	526	200	278.8	412	69	
57	10.0	-0.077	274	243	152	534	200	280.6	416	68	
58	9.8	-0.077	275	244	153	543	200	283.0	419	68	
59	9.7	-0.085	275	246	153	552	201	285.4	423	69	
60	9.5	-0.078	276	246	154	561	201	287.6	426	69	
61	9.4	-0.080	277	247	155	571	201	290.2	429	69	
62	9.2	-0.075	278	249	156	578	202	292.6	431	68	
63	9.1	-0.070	279	250	156	587	202	294.8	433	69	
64	9.0	-0.077	281	251	157	590	202	296.2	432	69	
65	8.8	-0.081	282	253	158	592	203	297.6	432	69	
66	8.6	-0.082	283	254	159	597	203	299.2	435	69	
67	8.6	-0.076	285	256	160	602	203	301.2	439	69	
68	8.4	-0.073	286	256	161	607	203	302.6	443	69	
69	8.3	-0.085	287	258	162	615	204	305.2	448	70	
70	8.0	-0.075	289	259	163	625	204	308.0	451	69	
71	7.9	-0.077	290	260	163	633	205	310.2	456	69	
72	7.8	-0.075	291	261	164	643	205	312.8	460	69	
73	7.7	-0.074	292	261	165	649	205	314.4	463	69	
74	7.5	-0.086	294	264	166	655	206	317.0	465	69	
75	7.2	-0.078	294	264	166	655	206	317.0	467	70	
76	7.2	-0.084	296	266	167	653	207	317.8	470	69	
77	7.0	-0.079	297	267	168	652	207	318.2	469	70	
78	6.9	-0.076	298	268	169	650	207	318.4	468	70	
79	6.8	-0.076	299	269	170	650	208	319.2	465	70	
80	6.6	-0.083	300	271	171	647	209	319.6	462	69	
81	6.5	-0.085	301	272	173	645	209	320.0	462	69	
82	6.3	-0.079	303	275	174	644	210	321.2	459	70	
83	6.2	-0.080	304	275	175	641	211	321.2	458	69	
84	6.0	-0.084	305	277	177	640	211	322.0	451	69	
85	5.9	-0.082	307	278	178	639	212	322.8	448	69	
86	5.8	-0.086	308	280	178	637	213	323.2	446	69	
87	5.6	-0.083	310	281	180	636	214	324.2	442	69	
88	5.5	-0.072	311	283	181	633	215	324.6	441	69	
89	5.4	-0.081	313	286	183	630	216	325.6	438	69	

WOODSTOVE PREBURN DATA - ASTM E2780

Client: MF Fire
 Model: Nova 2
 Run #: 3

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/16/2020

Recording Interval (min): 1
 Run Time (min): 122

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	Temperatures (°F)							Flue	Ambient
			FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average			
90	5.4	-0.077	315	286	184	629	218	326.4	437	70	
91	5.1	-0.088	317	288	185	627	219	327.2	434	70	
92	5.0	-0.079	319	289	186	622	220	327.2	429	70	
93	5.1	-0.081	321	290	187	616	221	327.0	424	70	
94	5.0	-0.077	322	292	188	610	222	326.8	421	70	
95	4.9	-0.076	324	293	188	601	223	325.8	415	70	
96	4.7	-0.074	326	294	190	592	224	325.2	410	70	
97	4.8	-0.076	327	294	191	582	225	323.8	407	70	
98	4.6	-0.071	328	296	192	571	227	322.8	401	69	
99	4.6	-0.075	329	296	192	560	228	321.0	398	69	
100	4.6	-0.074	330	296	193	551	229	319.8	394	70	
101	4.5	-0.079	331	296	194	540	230	318.2	391	70	
102	4.5	-0.081	331	297	194	531	231	316.8	388	69	
103	4.5	-0.068	332	297	195	521	232	315.4	385	70	
104	4.4	-0.065	332	297	195	513	233	314.0	381	69	
105	4.4	-0.066	333	298	195	504	234	312.8	377	70	
106	4.3	-0.077	333	298	195	496	235	311.4	375	70	
107	4.3	-0.072	333	298	195	490	236	310.4	373	70	
108	4.2	-0.073	333	297	195	483	237	309.0	371	70	
109	4.2	-0.066	333	299	195	477	238	308.4	368	69	
110	4.2	-0.064	333	297	196	471	239	307.2	366	69	
111	4.1	-0.061	332	297	195	466	240	306.0	364	69	
112	4.1	-0.070	332	297	196	461	241	305.4	362	70	
113	4.0	-0.066	332	296	196	456	242	304.4	362	70	
114	4.0	-0.064	332	296	196	452	243	303.8	360	70	
115	3.8	-0.070	332	297	196	449	244	303.6	358	69	
116	3.9	-0.062	331	297	196	446	245	303.0	357	69	
117	3.8	-0.071	331	296	196	443	246	302.4	356	70	
118	3.8	-0.072	331	294	197	440	247	301.8	355	69	
119	3.7	-0.066	330	295	197	438	248	301.6	355	70	
120	3.8	-0.068	329	294	198	435	249	301.0	354	70	
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BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 3

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/16/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.073	0.03	72	-0.01		16.2		105	356	72	70
1	0.123	0.123	0.094	1.80	72	-0.67	89	16.1	-0.1	114	350	72	70
2	0.252	0.129	0.088	1.78	72	-0.8	97	16.0	-0.1	115	356	73	70
3	0.381	0.129	0.086	1.77	72	-0.63	98	15.9	-0.1	115	357	73	69
4	0.516	0.135	0.078	1.78	72	-0.99	108	15.7	-0.2	113	346	74	69
5	0.644	0.128	0.083	1.78	72	-0.7	98	15.6	-0.1	107	336	74	69
6	0.774	0.130	0.088	1.79	72	-0.66	97	15.5	-0.1	105	341	74	69
7	0.908	0.134	0.100	1.79	73	-0.81	93	15.3	-0.2	104	351	74	69
8	1.037	0.129	0.091	1.79	73	-0.79	94	15.2	-0.1	104	367	74	68
9	1.168	0.131	0.082	1.81	73	-0.7	101	15.0	-0.2	105	386	74	69
10	1.301	0.133	0.089	1.79	73	-0.83	98	14.9	-0.1	105	383	74	69
11	1.431	0.130	0.090	1.80	73	-0.83	96	14.7	-0.2	105	375	74	69
12	1.563	0.132	0.092	1.81	73	-0.95	96	14.5	-0.2	105	377	74	69
13	1.696	0.133	0.080	1.80	74	-0.7	104	14.4	-0.1	106	384	74	68
14	1.827	0.131	0.090	1.79	74	-0.88	96	14.2	-0.2	106	399	74	68
15	1.958	0.131	0.085	1.83	74	-0.83	99	14.1	-0.1	106	407	74	68
16	2.092	0.134	0.094	1.80	74	-1.04	96	13.9	-0.2	107	411	74	68
17	2.223	0.131	0.077	1.82	75	-0.68	104	13.8	-0.1	107	411	74	68
18	2.355	0.132	0.087	1.82	75	-0.99	99	13.7	-0.1	107	411	74	69
19	2.490	0.135	0.077	1.82	75	-0.73	107	13.3	-0.4	108	417	74	68
20	2.619	0.129	0.077	1.85	76	-0.94	102	13.2	-0.1	109	425	75	68
21	2.754	0.135	0.077	1.82	76	-0.82	107	13.0	-0.2	109	433	75	68
22	2.888	0.134	0.089	1.84	76	-0.77	99	12.9	-0.1	109	435	74	68
23	3.017	0.129	0.076	1.81	76	-0.99	103	12.7	-0.2	110	439	75	68
24	3.154	0.137	0.085	1.81	77	-0.91	103	12.6	-0.1	110	442	75	68
25	3.285	0.131	0.081	1.85	77	-0.84	101	12.3	-0.3	110	444	75	68
26	3.418	0.133	0.075	1.84	77	-0.84	107	12.0	-0.3	110	446	74	69
27	3.553	0.135	0.083	1.83	78	-1.01	103	11.9	-0.1	110	449	75	68
28	3.685	0.132	0.088	1.84	78	-0.68	98	11.6	-0.3	110	451	75	68
29	3.817	0.132	0.076	1.85	78	-1.07	105	11.5	-0.1	111	450	75	69
30	3.954	0.137	0.070	1.84	79	-0.72	114	11.4	-0.1	111	450	75	69
31	4.084	0.130	0.096	1.83	79	-1.09	92	11.2	-0.2	111	450	75	69

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 3

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/16/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
32	4.220	0.136	0.070	1.85	79	-1	113	11.0	-0.2	111	450	75	69
33	4.354	0.134	0.074	1.86	80	-0.67	108	10.8	-0.2	111	450	75	69
34	4.485	0.131	0.079	1.84	80	-0.91	102	10.6	-0.2	111	451	75	69
35	4.623	0.138	0.086	1.85	80	-0.94	103	10.3	-0.3	112	454	75	69
36	4.754	0.131	0.083	1.83	80	-0.9	100	10.2	-0.1	112	458	75	69
37	4.888	0.134	0.094	1.85	81	-0.67	96	9.9	-0.3	112	462	75	69
38	5.023	0.135	0.089	1.85	81	-1.16	99	9.7	-0.2	113	465	75	68
39	5.156	0.133	0.083	1.84	81	-0.6	101	9.5	-0.2	113	467	75	69
40	5.289	0.133	0.083	1.84	82	-0.98	101	9.4	-0.1	113	465	75	69
41	5.427	0.138	0.087	1.84	82	-0.9	102	9.3	-0.1	113	464	75	69
42	5.557	0.130	0.079	1.84	82	-1.01	101	9.0	-0.3	113	463	75	69
43	5.696	0.139	0.088	1.84	82	-0.82	102	8.8	-0.2	113	465	75	69
44	5.828	0.132	0.073	1.87	83	-0.96	107	8.6	-0.2	114	467	75	69
45	5.963	0.135	0.072	1.86	83	-0.65	110	8.4	-0.2	114	471	75	70
46	6.099	0.136	0.092	1.85	83	-0.81	98	8.1	-0.3	114	475	75	69
47	6.233	0.134	0.086	1.86	84	-0.73	100	8.0	-0.1	114	476	75	69
48	6.365	0.132	0.084	1.79	84	-0.86	99	7.8	-0.2	114	477	75	69
49	6.500	0.135	0.075	1.78	84	-0.72	107	7.6	-0.2	114	478	75	69
50	6.629	0.129	0.084	1.82	84	-0.96	97	7.4	-0.2	114	476	75	69
51	6.763	0.134	0.081	1.79	85	-0.93	102	7.2	-0.2	114	473	75	69
52	6.896	0.133	0.076	1.80	85	-0.78	105	7.1	-0.1	114	472	75	69
53	7.025	0.129	0.084	1.79	85	-0.74	97	6.9	-0.2	113	471	75	69
54	7.162	0.137	0.077	1.78	85	-1.02	107	6.8	-0.1	114	471	74	69
55	7.292	0.130	0.080	1.79	86	-0.76	100	6.5	-0.3	113	470	74	69
56	7.424	0.132	0.076	1.77	86	-0.69	104	6.5	0	113	467	74	69
57	7.559	0.135	0.087	1.80	86	-0.95	99	6.3	-0.2	113	462	74	69
58	7.691	0.132	0.087	1.79	86	-0.63	97	6.2	-0.1	112	458	74	69
59	7.823	0.132	0.078	1.83	86	-0.8	102	6.1	-0.1	112	454	74	69
60	7.960	0.137	0.078	1.83	87	-0.82	106	6.0	-0.1	112	452	74	68
61	8.092	0.132	0.080	1.84	87	-0.78	101	5.9	-0.1	112	451	74	69
62	8.227	0.135	0.086	1.85	87	-0.71	100	5.8	-0.1	112	448	73	69
63	8.361	0.134	0.083	1.83	87	-0.92	101	5.7	-0.1	111	446	73	68

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF FireJob #: 20-606Model: Nova 2Tracking #: 74Run #: 3Technician: A KravitzDate: 6/16/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
64	8.492	0.131	0.090	1.85	87	-0.85	94	5.5	-0.2	111	444	73	69
65	8.630	0.138	0.072	1.83	88	-1.08	111	5.4	-0.1	111	442	73	69
66	8.762	0.132	0.094	1.82	88	-0.89	93	5.3	-0.1	111	439	73	69
67	8.896	0.134	0.077	1.82	88	-0.55	104	5.2	-0.1	111	438	73	69
68	9.032	0.136	0.084	1.82	88	-0.73	101	5.1	-0.1	111	435	73	69
69	9.165	0.133	0.084	1.82	88	-0.7	99	4.9	-0.2	111	431	73	69
70	9.300	0.135	0.083	1.84	89	-0.67	101	4.9	0	110	429	73	70
71	9.435	0.135	0.078	1.83	89	-0.59	104	4.6	-0.3	110	425	73	69
72	9.564	0.129	0.084	1.81	89	-0.86	96	4.6	0	110	423	74	69
73	9.702	0.138	0.079	1.79	89	-0.84	106	4.6	0	110	420	74	69
74	9.833	0.131	0.075	1.80	89	-0.7	103	4.5	-0.1	110	416	74	70
75	9.966	0.133	0.088	1.82	89	-1.12	96	4.4	-0.1	109	413	74	69
76	10.102	0.136	0.083	1.83	90	-0.68	101	4.3	-0.1	109	410	74	69
77	10.234	0.132	0.079	1.81	90	-0.95	101	4.2	-0.1	109	408	74	69
78	10.367	0.133	0.076	1.84	90	-0.8	103	4.1	-0.1	109	407	74	69
79	10.504	0.137	0.084	1.83	90	-0.84	101	4.0	-0.1	108	405	74	70
80	10.635	0.131	0.090	1.80	90	-0.9	94	3.9	-0.1	108	402	74	69
81	10.772	0.137	0.086	1.82	90	-1.02	100	3.8	-0.1	108	401	74	69
82	10.905	0.133	0.074	1.84	91	-0.71	105	3.8	0	108	398	74	69
83	11.038	0.133	0.076	1.83	91	-0.92	103	3.7	-0.1	107	395	74	69
84	11.174	0.136	0.084	1.82	91	-0.62	100	3.6	-0.1	107	394	74	69
85	11.308	0.134	0.092	1.82	91	-0.62	94	3.5	-0.1	107	393	74	69
86	11.440	0.132	0.085	1.83	91	-0.99	97	3.4	-0.1	107	391	74	69
87	11.576	0.136	0.082	1.78	91	-0.62	102	3.3	-0.1	107	391	74	69
88	11.706	0.130	0.087	1.77	91	-0.97	94	3.3	0	106	390	74	69
89	11.838	0.132	0.100	1.77	91	-0.94	89	3.2	-0.1	106	389	74	69
90	11.973	0.135	0.070	1.78	91	-0.69	109	3.1	-0.1	106	388	74	69
91	12.103	0.130	0.081	1.78	92	-0.83	97	3.0	-0.1	106	386	74	69
92	12.238	0.135	0.077	1.79	92	-0.59	104	3.0	0	106	385	74	69
93	12.370	0.132	0.074	1.79	92	-0.69	103	2.9	-0.1	106	384	74	69
94	12.501	0.131	0.076	1.77	92	-0.69	101	2.8	-0.1	106	384	74	69
95	12.637	0.136	0.079	1.80	92	-0.73	103	2.7	-0.1	106	384	74	69

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF FireJob #: 20-606Model: Nova 2Tracking #: 74Run #: 3Technician: A KravitzDate: 6/16/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
96	12.767	0.130	0.083	1.78	92	-0.8	96	2.6	-0.1	105	383	74	69
97	12.900	0.133	0.090	1.81	92	-0.62	95	2.6	0	106	382	74	69
98	13.035	0.135	0.086	1.80	92	-0.78	98	2.5	-0.1	105	382	74	69
99	13.167	0.132	0.083	1.77	92	-0.93	98	2.3	-0.2	105	382	74	69
100	13.298	0.131	0.077	1.77	93	-0.82	100	2.2	-0.1	105	382	74	68
101	13.434	0.136	0.083	1.78	93	-0.86	100	2.2	0	105	382	74	69
102	13.564	0.130	0.067	1.79	93	-0.57	107	2.2	0	105	381	74	70
103	13.698	0.134	0.086	1.79	93	-0.84	97	2.1	-0.1	105	379	74	69
104	13.833	0.135	0.083	1.79	93	-0.65	100	2.1	0	105	378	74	69
105	13.962	0.129	0.078	1.77	93	-0.88	98	2.0	-0.1	104	377	74	70
106	14.099	0.137	0.078	1.79	93	-0.73	104	2.0	0	104	377	74	70
107	14.230	0.131	0.080	1.78	93	-0.98	98	1.9	-0.1	104	375	74	70
108	14.363	0.133	0.084	1.78	93	-0.79	97	1.9	0	104	373	74	70
109	14.498	0.135	0.087	1.77	93	-0.91	97	1.8	-0.1	104	372	74	69
110	14.630	0.132	0.076	1.77	93	-0.84	102	1.8	0	104	369	74	70
111	14.762	0.132	0.087	1.80	93	-0.79	95	1.8	0	104	369	74	70
112	14.898	0.136	0.075	1.80	93	-0.82	105	1.7	-0.1	103	368	74	70
113	15.029	0.131	0.084	1.80	94	-0.69	96	1.7	0	103	366	74	70
114	15.162	0.133	0.088	1.78	94	-1.01	95	1.6	-0.1	103	366	74	70
115	15.298	0.136	0.093	1.78	94	-1.05	94	1.5	-0.1	103	364	74	70
116	15.427	0.129	0.085	1.78	94	-1.05	94	1.5	0	103	362	74	69
117	15.564	0.137	0.069	1.78	94	-0.9	110	1.5	0	103	361	74	69
118	15.696	0.132	0.074	1.80	94	-0.94	103	1.5	0	103	360	74	70
119	15.829	0.133	0.087	1.80	94	-0.96	96	1.4	-0.1	103	359	74	69
120	15.964	0.135	0.082	1.80	94	-0.9	100	1.4	0	103	357	74	70
121	16.097	0.133	0.083	1.78	94	-0.97	98	1.3	-0.1	102	356	74	69
122	16.228	0.131	0.084	1.80	94	-0.84	96	1.3	0	102	354	74	69
123	16.365	0.137	0.069	1.79	94	-0.62	110	1.3	0	102	352	74	69
124	16.496	0.131	0.073	1.80	94	-0.93	103	1.3	0	102	351	74	70
125	16.630	0.134	0.083	1.81	94	-0.72	98	1.2	-0.1	102	349	74	69
126	16.765	0.135	0.087	1.79	94	-0.85	97	1.2	0	102	348	74	69
127	16.895	0.130	0.089	1.79	94	-0.71	92	1.2	0	102	347	74	69

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 3

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/16/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
128	17.033	0.138	0.086	1.81	94	-0.8	100	1.1	-0.1	101	347	74	69
129	17.164	0.131	0.081	1.80	95	-0.7	97	1.1	0	101	346	74	70
130	17.297	0.133	0.068	1.78	95	-0.58	108	1.1	0	101	345	74	69
131	17.433	0.136	0.078	1.79	95	-0.78	103	1.0	-0.1	101	345	74	69
132	17.565	0.132	0.088	1.80	95	-0.59	94	1.0	0	101	344	74	70
133	17.698	0.133	0.087	1.79	95	-0.61	95	1.0	0	101	343	74	70
134	17.834	0.136	0.071	1.80	95	-0.93	108	0.9	-0.1	101	343	74	70
135	17.965	0.131	0.076	1.81	95	-0.61	100	0.9	0	101	341	74	70
136	18.102	0.137	0.078	1.83	95	-0.73	104	0.9	0	101	342	74	70
137	18.234	0.132	0.081	1.78	95	-0.7	98	0.8	-0.1	101	341	74	70
138	18.366	0.132	0.076	1.79	95	-0.65	101	0.8	0	101	340	74	70
139	18.503	0.137	0.076	1.81	95	-0.72	105	0.8	0	101	338	74	70
140	18.636	0.133	0.080	1.79	95	-0.76	99	0.8	0	100	338	74	69
141	18.768	0.132	0.084	1.81	95	-0.9	96	0.7	-0.1	100	336	74	70
142	18.905	0.137	0.078	1.80	95	-0.44	103	0.7	0	100	335	74	70
143	19.036	0.131	0.085	1.81	95	-0.71	95	0.6	-0.1	100	335	74	70
144	19.170	0.134	0.080	1.80	95	-0.68	100	0.6	0	101	335	74	70
145	19.306	0.136	0.092	1.80	95	-0.75	95	0.6	0	101	335	74	70
146	19.436	0.130	0.078	1.79	95	-1.03	98	0.6	0	100	334	74	70
147	19.574	0.138	0.082	1.82	95	-0.66	102	0.5	-0.1	100	333	74	70
148	19.705	0.131	0.090	1.82	95	-0.94	92	0.5	0	100	332	74	70
149	19.839	0.134	0.091	1.79	95	-0.92	94	0.5	0	100	332	74	70
150	19.975	0.136	0.076	1.79	95	-0.65	104	0.4	-0.1	100	331	74	70
151	20.107	0.132	0.081	1.83	95	-0.68	98	0.4	0	100	331	74	70
152	20.241	0.134	0.082	1.81	95	-0.87	99	0.4	0	100	331	74	70
153	20.377	0.136	0.068	1.82	96	-0.75	110	0.4	0	100	330	74	70
154	20.508	0.131	0.091	1.81	96	-0.85	91	0.3	-0.1	100	331	74	70
155	20.644	0.136	0.086	1.79	96	-0.53	98	0.3	0	100	330	74	70
156	20.776	0.132	0.085	1.77	96	-0.73	95	0.2	-0.1	99	329	74	70
157	20.909	0.133	0.088	1.81	96	-0.7	94	0.2	0	99	328	74	71
158	21.044	0.135	0.084	1.81	96	-0.62	98	0.2	0	99	329	74	70
159	21.178	0.134	0.085	1.81	96	-0.94	97	0.2	0	99	328	74	71

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire Job #: 20-606
 Model: Nova 2 Tracking #: 74
 Run #: 3 Technician: A Kravitz
 Date: 6/16/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
160	21.310	0.132	0.081	1.80	96	-0.78	98	0.1	-0.1	99	328	74	70
161	21.447	0.137	0.080	1.80	96	-0.87	102	0.1	0	99	327	74	71
162	21.578	0.131	0.073	1.82	96	-0.82	102	0.1	0	99	327	74	71
163	21.714	0.136	0.083	1.82	96	-0.59	99	0.0	-0.1	99	326	74	71
Avg/Tot	21.714	0.133	0.082	1.80	88	-0.80	100			107	393	74	69.2

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 3

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/16/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
0	0.000		0.00	78	-1		72	0.000	6.48	0.12
1	0.122	0.122	1.78	78	-3.07	89	72	-0.060	4.52	0.08
2	0.250	0.128	1.78	78	-3.33	97	73	-0.070	2.18	0.27
3	0.377	0.127	1.80	78	-3.03	97	73	-0.070	2.28	0.23
4	0.509	0.132	1.81	78	-0.86	106	73	-0.060	2.80	0.33
5	0.639	0.130	1.80	78	-0.25	100	73	-0.070	5.08	0.75
6	0.766	0.127	1.80	78	-3.33	95	73	-0.080	5.78	0.56
7	0.898	0.132	1.80	79	0	92	73	-0.060	6.47	0.49
8	1.029	0.131	1.80	79	-1.35	96	73	-0.080	7.93	0.38
9	1.155	0.126	1.79	79	0	97	73	-0.080	8.85	0.32
10	1.286	0.131	1.80	79	-3.35	97	73	-0.070	6.04	0.20
11	1.418	0.132	1.80	79	0	97	73	-0.070	5.70	0.30
12	1.544	0.126	1.80	80	-0.32	92	73	-0.070	6.59	0.23
13	1.675	0.131	1.80	80	-2.9	103	73	-0.080	6.50	0.30
14	1.806	0.131	1.79	80	0	97	73	-0.080	9.68	0.17
15	1.933	0.127	1.82	81	-2.67	96	73	-0.080	10.51	0.14
16	2.063	0.130	1.79	81	-3.37	94	73	-0.070	8.14	0.17
17	2.196	0.133	1.81	81	-2.74	106	73	-0.070	7.57	0.17
18	2.324	0.128	1.81	81	0	96	73	-0.070	7.55	0.13
19	2.453	0.129	1.80	82	-2.61	103	73	-0.080	10.21	0.16
20	2.586	0.133	1.81	82	-0.3	106	74	-0.070	10.59	0.16
21	2.714	0.128	1.81	82	0	102	74	-0.080	13.57	0.25
22	2.844	0.130	1.80	82	0	96	74	-0.080	11.25	0.09
23	2.977	0.133	1.81	83	0	107	74	-0.080	11.34	0.08
24	3.105	0.128	1.82	83	-0.41	97	74	-0.090	13.12	0.20
25	3.235	0.130	1.81	83	-1.06	101	74	-0.080	11.57	0.17
26	3.368	0.133	1.81	83	-1.33	107	74	-0.080	10.96	0.11
27	3.497	0.129	1.81	84	-2.53	99	74	-0.080	12.60	0.12
28	3.627	0.130	1.81	84	-3.17	97	74	-0.080	13.03	0.15
29	3.761	0.134	1.81	84	0	107	74	-0.080	12.67	0.09
30	3.889	0.128	1.81	84	-0.2	107	74	-0.080	12.96	0.03
31	4.021	0.132	1.82	85	-2.8	94	74	-0.080	13.11	0.06

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 3

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/16/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
32	4.154	0.133	1.81	85	-1.62	111	74	-0.070	12.98	0.06
33	4.283	0.129	1.82	85	-2.53	104	74	-0.070	13.09	0.12
34	4.415	0.132	1.81	86	-0.35	103	74	-0.080	13.31	0.05
35	4.548	0.133	1.82	86	-2.98	100	74	-0.080	13.69	0.05
36	4.676	0.128	1.82	86	-2.82	98	74	-0.080	14.21	0.07
37	4.810	0.134	1.82	86	-2.36	96	74	-0.080	14.66	0.02
38	4.941	0.131	1.81	86	-1.74	97	74	-0.080	15.00	0.10
39	5.072	0.131	1.82	87	-0.37	100	74	-0.090	14.95	0.13
40	5.206	0.134	1.82	87	-0.02	102	74	-0.080	14.17	0.05
41	5.336	0.130	1.83	87	0	97	74	-0.080	13.73	0.02
42	5.468	0.132	1.84	87	-2.8	103	74	-0.090	13.98	0.04
43	5.601	0.133	1.83	88	-2.7	98	74	-0.090	14.18	0.06
44	5.733	0.132	1.83	88	-3.3	107	74	-0.080	14.65	0.08
45	5.865	0.132	1.83	88	-0.23	108	74	-0.080	15.22	0.08
46	5.998	0.133	1.83	88	0	96	74	-0.080	15.28	0.14
47	6.130	0.132	1.83	88	-0.39	99	74	-0.090	15.30	0.11
48	6.259	0.129	1.81	89	0	98	74	-0.080	15.12	0.10
49	6.394	0.135	1.82	89	-0.37	108	74	-0.080	15.14	0.08
50	6.525	0.131	1.83	89	0	99	74	-0.070	14.63	0.03
51	6.655	0.130	1.82	89	0	100	74	-0.090	13.59	0.07
52	6.790	0.135	1.82	89	-0.45	107	73	-0.080	13.61	0.04
53	6.920	0.130	1.82	90	-1.8	98	73	-0.080	13.65	0.10
54	7.053	0.133	1.82	90	-0.14	105	73	-0.090	13.65	0.13
55	7.187	0.134	1.82	90	-0.06	104	73	-0.080	13.17	0.04
56	7.316	0.129	1.82	90	-2.86	102	73	-0.080	12.79	0.00
57	7.451	0.135	1.82	90	-0.49	100	73	-0.080	12.13	0.02
58	7.583	0.132	1.83	90	-0.05	98	73	-0.090	11.65	0.02
59	7.715	0.132	1.83	91	-2.7	103	73	-0.080	11.70	0.04
60	7.849	0.134	1.82	91	-3.21	105	73	-0.080	11.61	0.05
61	7.981	0.132	1.83	91	0	102	72	-0.070	11.81	0.06
62	8.113	0.132	1.83	91	-1.15	98	72	-0.080	11.62	0.04
63	8.247	0.134	1.83	91	-1.91	101	72	-0.080	11.65	0.01

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 3

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/16/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
64	8.380	0.133	1.83	91	-3.14	97	72	-0.080	11.65	0.03
65	8.512	0.132	1.83	92	-0.23	107	72	-0.090	11.44	0.02
66	8.647	0.135	1.83	92	-1.3	96	72	-0.070	11.38	0.02
67	8.777	0.130	1.83	92	-2.06	102	72	-0.080	11.33	0.01
68	8.911	0.134	1.82	92	0	101	73	-0.080	11.21	0.02
69	9.046	0.135	1.84	92	-3.26	101	73	-0.080	11.12	0.03
70	9.176	0.130	1.83	92	-2.3	98	73	-0.070	11.00	0.04
71	9.311	0.135	1.78	92	-0.1	105	73	-0.080	10.92	0.01
72	9.442	0.131	1.79	93	-3.23	98	73	-0.080	10.89	0.07
73	9.573	0.131	1.78	93	0	101	73	-0.080	10.66	0.03
74	9.706	0.133	1.79	93	-1.23	105	72	-0.080	10.56	0.06
75	9.836	0.130	1.79	93	-1.75	95	72	-0.080	10.50	0.01
76	9.968	0.132	1.79	93	-3.38	99	72	-0.070	10.41	0.03
77	10.101	0.133	1.80	93	-2.68	103	72	-0.070	10.31	0.04
78	10.232	0.131	1.78	93	-1.15	103	72	-0.070	10.29	0.03
79	10.363	0.131	1.80	93	-3.23	98	73	-0.080	10.16	0.02
80	10.496	0.133	1.79	94	0	96	73	-0.070	10.18	0.03
81	10.628	0.132	1.80	94	-3.33	97	73	-0.070	10.27	0.03
82	10.759	0.131	1.80	94	-0.94	104	73	-0.070	10.03	0.06
83	10.894	0.135	1.79	94	-3.03	106	73	-0.080	10.29	0.02
84	11.024	0.130	1.80	94	-0.09	97	73	-0.060	10.16	0.01
85	11.156	0.132	1.79	94	-0.37	94	73	-0.070	10.03	0.02
86	11.291	0.135	1.78	94	-0.06	100	73	-0.070	10.02	0.05
87	11.420	0.129	1.80	94	0	97	73	-0.070	9.90	0.03
88	11.554	0.134	1.80	94	-0.18	98	73	-0.070	9.95	0.01
89	11.686	0.132	1.80	94	-2.86	90	73	-0.070	10.02	0.04
90	11.818	0.132	1.80	95	-0.51	107	73	-0.070	10.22	0.02
91	11.952	0.134	1.80	95	-3.33	101	73	-0.070	10.10	0.03
92	12.083	0.131	1.79	95	-1.51	102	73	-0.070	10.01	0.04
93	12.215	0.132	1.80	95	-0.54	104	73	-0.070	9.94	0.02
94	12.349	0.134	1.81	95	-2.59	105	73	-0.080	9.97	0.00
95	12.481	0.132	1.80	95	-3.3	101	73	-0.060	9.93	0.02

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 3

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/16/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
96	12.612	0.131	1.81	95	-3.14	98	73	-0.070	10.05	0.02
97	12.746	0.134	1.80	95	-1.52	96	73	-0.070	10.12	0.04
98	12.879	0.133	1.80	95	-3.15	98	73	-0.070	10.07	0.03
99	13.010	0.131	1.80	95	-3.31	98	73	-0.060	9.91	0.04
100	13.145	0.135	1.80	95	-3.19	105	73	-0.070	10.79	0.00
101	13.276	0.131	1.81	95	0	98	73	-0.070	10.72	0.00
102	13.409	0.133	1.80	95	-2.62	111	73	-0.070	10.37	0.05
103	13.543	0.134	1.80	96	-2.6	98	73	-0.060	10.21	0.04
104	13.673	0.130	1.79	96	-0.35	97	73	-0.070	8.88	0.04
105	13.809	0.136	1.81	96	-1.53	104	73	-0.070	8.35	0.06
106	13.940	0.131	1.79	96	-3.26	101	73	-0.070	8.13	0.05
107	14.072	0.132	1.80	96	-1.86	100	73	-0.070	8.08	0.09
108	14.206	0.134	1.81	96	-3.05	99	73	-0.060	8.03	0.07
109	14.339	0.133	1.80	96	-0.01	97	74	-0.070	8.04	0.04
110	14.470	0.131	1.81	96	-3.34	102	74	-0.070	7.89	0.08
111	14.605	0.135	1.79	96	-1.6	98	74	-0.070	7.72	0.08
112	14.737	0.132	1.80	96	-0.41	103	74	-0.060	7.50	0.10
113	14.868	0.131	1.80	96	0	97	74	-0.070	7.70	0.07
114	15.004	0.136	1.80	96	-3.11	98	74	-0.070	7.66	0.05
115	15.134	0.130	1.80	96	-1.88	91	74	-0.070	7.60	0.08
116	15.269	0.135	1.80	96	-3.16	99	74	-0.070	7.72	0.07
117	15.402	0.133	1.81	96	-1.7	109	74	-0.070	7.62	0.10
118	15.533	0.131	1.80	97	-0.09	103	74	-0.070	7.79	0.09
119	15.668	0.135	1.80	97	-0.22	98	74	-0.070	7.84	0.04
120	15.800	0.132	1.80	97	-1.33	99	74	-0.070	7.61	0.07
121	15.933	0.133	1.83	97	0	99	74	-0.080	7.45	0.12
122	16.067	0.134	1.81	97	-2.77	99	74	-0.060	7.44	0.04
123	16.200	0.133	1.81	97	-2.44	108	74	-0.060	7.61	0.07
124	16.332	0.132	1.80	97	-3.33	104	74	-0.070	7.40	0.07
125	16.467	0.135	1.80	97	0	100	74	-0.060	7.29	0.07
126	16.597	0.130	1.80	97	-0.19	94	74	-0.060	7.33	0.03
127	16.731	0.134	1.80	97	-1.77	96	74	-0.070	7.38	0.10

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 3

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/16/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
128	16.866	0.135	1.81	97	-0.01	98	74	-0.070	7.30	0.09
129	16.996	0.130	1.80	97	-2.72	98	74	-0.070	7.44	0.05
130	17.133	0.137	1.82	97	-2.12	112	74	-0.070	7.37	0.06
131	17.264	0.131	1.80	97	-1.54	100	74	-0.070	7.42	0.07
132	17.397	0.133	1.81	97	-0.99	96	74	-0.070	7.34	0.09
133	17.531	0.134	1.80	97	0	97	74	-0.070	7.43	0.09
134	17.664	0.133	1.81	97	-2.44	107	74	-0.060	7.36	0.10
135	17.796	0.132	1.80	97	-3.33	102	74	-0.070	7.32	0.08
136	17.932	0.136	1.80	97	-0.22	104	74	-0.070	7.36	0.10
137	18.063	0.131	1.81	97	-0.26	98	74	-0.070	7.23	0.09
138	18.197	0.134	1.81	98	-3.33	104	74	-0.070	6.94	0.08
139	18.332	0.135	1.80	98	-0.03	104	74	-0.060	6.78	0.06
140	18.462	0.130	1.80	98	0	98	74	-0.060	6.82	0.07
141	18.598	0.136	1.81	98	-3.08	100	74	-0.070	6.73	0.11
142	18.730	0.132	1.81	98	0	101	74	-0.070	6.92	0.08
143	18.863	0.133	1.80	98	-0.52	97	74	-0.060	6.66	0.10
144	18.997	0.134	1.81	98	-0.37	101	74	-0.070	6.80	0.09
145	19.130	0.133	1.81	98	-1.83	94	74	-0.060	6.83	0.07
146	19.262	0.132	1.80	98	-0.85	101	74	-0.060	6.91	0.09
147	19.398	0.136	1.82	98	-3.2	101	74	-0.060	6.83	0.11
148	19.529	0.131	1.81	98	-0.08	93	73	-0.060	6.97	0.10
149	19.663	0.134	1.81	98	-2.55	95	74	-0.060	7.03	0.10
150	19.798	0.135	1.80	98	-2.84	104	74	-0.060	6.95	0.09
151	19.929	0.131	1.81	98	0	98	74	-0.060	7.07	0.06
152	20.065	0.136	1.80	98	-2.58	101	74	-0.060	7.08	0.09
153	20.197	0.132	1.81	98	-0.15	108	74	-0.070	7.04	0.06
154	20.330	0.133	1.80	98	-3.14	94	74	-0.070	6.85	0.08
155	20.464	0.134	1.81	98	-0.67	97	74	-0.060	7.05	0.09
156	20.597	0.133	1.80	98	-0.36	97	74	-0.070	7.11	0.08
157	20.729	0.132	1.82	98	-0.16	95	74	-0.070	7.01	0.09
158	20.865	0.136	1.80	98	0	100	74	-0.060	6.91	0.05
159	20.996	0.131	1.81	98	-2.34	96	74	-0.060	6.73	0.14

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 3

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/16/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
160	21.130	0.134	1.79	98	-2.91	100	74	-0.060	6.71	0.09
161	21.265	0.135	1.81	98	-3.29	102	74	-0.060	6.73	0.07
162	21.397	0.132	1.81	98	0	104	74	-0.070	6.75	0.11
163	21.532	0.135	1.81	98	-0.31	100	74	-0.060	6.81	0.10
Avg/Tot	21.532	0.132	1.80	91	-1.48	100	73	-0.072	9.57	0.09

WOODSTOVE SURFACE TEMPERATURE DATA

Client: MF Fire
 Model: Nova 2
 Run #: 3

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/16/2020

Stove ΔT: 0

Temperature Data (°F)							
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
0	328	293	198	425	251	299.0	629
1	328	294	199	414	252	297.4	513
2	327	293	200	402	253	295.0	540
3	327	293	200	390	254	292.8	542
4	326	294	200	382	254	291.2	547
5	325	293	200	373	255	289.2	648
6	324	292	199	367	255	287.4	685
7	323	291	199	362	256	286.2	691
8	321	289	197	362	256	285.0	728
9	320	289	197	365	256	285.4	764
10	317	287	196	364	256	284.0	717
11	316	285	194	365	256	283.2	677
12	314	284	193	364	256	282.2	722
13	312	281	192	371	257	282.6	778
14	310	279	191	384	257	284.2	859
15	308	280	189	404	257	287.6	893
16	306	277	188	419	257	289.4	883
17	305	275	187	419	257	288.6	846
18	303	275	185	416	257	287.2	828
19	302	272	185	425	257	288.2	874
20	300	271	183	441	257	290.4	932
21	299	270	182	461	257	293.8	944
22	298	268	182	473	257	295.6	923
23	297	267	181	487	257	297.8	922
24	296	266	180	507	258	301.4	948
25	295	265	179	523	258	304.0	922
26	294	264	179	532	258	305.4	922
27	294	264	178	543	258	307.4	936
28	293	263	178	555	258	309.4	940
29	293	262	178	563	258	310.8	932
30	293	262	177	572	258	312.4	928
31	293	263	178	581	258	314.6	922
32	293	263	177	587	258	315.6	922
33	293	264	178	592	258	317.0	928
34	294	264	178	597	258	318.2	942
35	295	264	179	603	258	319.8	958
36	296	265	178	612	258	321.8	992
37	297	266	179	622	258	324.4	1014
38	298	267	180	631	258	326.8	1021
39	299	268	180	640	258	329.0	1023
40	300	270	181	645	258	330.8	1000
41	301	270	182	648	258	331.8	996
42	303	272	183	650	258	333.2	1006
43	304	274	183	653	257	334.2	1018
44	306	276	184	657	257	336.0	1036
45	307	276	184	664	257	337.6	1056
46	309	280	185	670	257	340.2	1064
47	311	280	186	677	257	342.2	1067

WOODSTOVE SURFACE TEMPERATURE DATA

Client: MF Fire
 Model: Nova 2
 Run #: 3

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/16/2020

Stove ΔT: 0

Temperature Data (°F)							
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
48	312	281	187	682	257	343.8	1062
49	314	284	188	686	257	345.8	1048
50	315	284	189	689	257	346.8	1045
51	317	287	189	687	257	347.4	1031
52	319	288	190	688	257	348.4	1035
53	321	289	191	686	257	348.8	1016
54	322	292	192	688	257	350.2	1015
55	324	293	192	688	256	350.6	1032
56	325	295	193	686	256	351.0	1018
57	327	296	193	681	256	350.6	989
58	328	297	194	675	256	350.0	966
59	329	298	195	668	256	349.2	956
60	330	300	196	660	256	348.4	948
61	331	299	196	652	256	346.8	945
62	332	300	197	646	256	346.2	941
63	333	303	198	639	256	345.8	936
64	334	303	199	632	256	344.8	929
65	335	304	200	627	256	344.4	922
66	335	305	200	620	256	343.2	917
67	336	303	201	613	257	342.0	911
68	336	305	202	607	257	341.4	903
69	337	305	204	602	258	341.2	894
70	337	306	205	596	258	340.4	890
71	338	307	206	589	258	339.6	882
72	338	305	207	584	259	338.6	873
73	339	305	208	578	259	337.8	867
74	339	307	209	572	259	337.2	861
75	339	307	210	566	260	336.4	853
76	340	307	211	561	260	335.8	849
77	340	309	212	556	261	335.6	846
78	340	308	213	551	261	334.6	841
79	341	308	213	546	261	333.8	836
80	341	309	214	542	262	333.6	833
81	341	309	214	538	263	333.0	830
82	341	311	214	534	263	332.6	826
83	342	307	215	530	263	331.4	823
84	342	311	216	526	264	331.8	820
85	342	311	216	524	264	331.4	818
86	342	312	217	520	265	331.2	816
87	342	311	217	518	266	330.8	813
88	342	311	218	516	266	330.6	810
89	343	313	218	513	267	330.8	808
90	343	314	218	511	268	330.8	806
91	343	313	219	509	268	330.4	802
92	343	313	219	508	269	330.4	801
93	343	314	220	507	269	330.6	800
94	344	314	220	505	270	330.6	801
95	343	314	221	504	270	330.4	802

WOODSTOVE SURFACE TEMPERATURE DATA

Client: MF Fire
 Model: Nova 2
 Run #: 3

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/16/2020

Stove ΔT: 0

Temperature Data (°F)							
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
96	343	314	222	503	271	330.6	803
97	344	314	222	504	271	331.0	804
98	344	313	221	503	272	330.6	805
99	343	313	221	504	273	330.8	805
100	343	315	223	507	273	332.2	811
101	344	314	222	509	274	332.6	812
102	344	315	223	511	275	333.6	810
103	344	314	224	511	275	333.6	800
104	344	316	223	509	276	333.6	791
105	344	316	223	506	276	333.0	788
106	344	316	224	501	277	332.4	784
107	344	317	224	497	277	331.8	783
108	344	318	223	493	278	331.2	780
109	344	317	224	488	279	330.4	777
110	344	317	223	484	279	329.4	774
111	344	318	222	480	280	328.8	770
112	344	318	223	476	281	328.4	766
113	343	320	222	472	282	327.8	763
114	343	318	222	468	282	326.6	760
115	343	319	222	464	283	326.2	758
116	342	318	220	461	283	324.8	755
117	342	318	220	457	284	324.2	753
118	341	317	220	454	284	323.2	749
119	341	319	219	452	285	323.2	744
120	340	317	218	448	285	321.6	740
121	340	318	217	444	286	321.0	736
122	339	317	217	441	286	320.0	731
123	338	318	217	438	287	319.6	728
124	337	317	216	435	287	318.4	724
125	337	318	216	432	288	318.2	723
126	336	317	216	429	288	317.2	721
127	335	317	216	426	288	316.4	720
128	335	315	216	424	289	315.8	719
129	334	316	215	421	289	315.0	717
130	333	316	215	420	290	314.8	716
131	332	315	215	418	290	314.0	715
132	332	315	215	416	290	313.6	714
133	331	314	214	414	291	312.8	712
134	330	312	214	412	291	311.8	710
135	329	312	214	410	291	311.2	707
136	329	312	213	408	292	310.8	707
137	328	312	212	407	292	310.2	703
138	328	312	213	405	293	310.2	699
139	327	311	212	403	293	309.2	697
140	326	311	211	402	293	308.6	696
141	326	309	212	400	293	308.0	695
142	325	309	212	399	294	307.8	695
143	325	308	211	397	294	307.0	695

WOODSTOVE SURFACE TEMPERATURE DATA

Client: MF Fire
 Model: Nova 2
 Run #: 3

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/16/2020

Stove ΔT: 0

Temperature Data (°F)							
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
144	324	306	211	396	294	306.2	694
145	324	307	210	394	294	305.8	691
146	323	306	209	393	294	305.0	690
147	322	306	209	391	294	304.4	686
148	322	305	208	391	295	304.2	679
149	322	306	208	389	295	304.0	676
150	321	303	208	388	295	303.0	675
151	320	300	208	388	295	302.2	675
152	319	298	207	387	295	301.2	673
153	319	302	207	386	296	302.0	673
154	319	299	207	385	296	301.2	672
155	318	299	206	385	296	300.8	670
156	318	300	206	384	296	300.8	669
157	318	301	206	384	296	301.0	668
158	317	301	205	383	296	300.4	668
159	317	296	205	381	296	299.0	671
160	317	298	205	381	297	299.6	671
161	317	297	205	380	297	299.2	671
162	317	296	204	378	296	298.2	670
163	317	298	205	378	297	299.0	670
Average	325	298	204	501	270	320	817

LAB SAMPLE DATA - ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 3

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/16/2020

	Sample ID	Tare, mg	Total, mg	Final, mg	Catch, mg
Train A Filters - First Hour	A019	118.5	118.5	121.6	3.1
Train A Filters - Remainder	A020	119.7	240.0	240.2	0.2
	A021	120.3			
Train A Probe	11A	117036.7	117036.7	117037.1	0.4
Train A O-Rings	11A	3417.5	3417.5	3418.8	1.3
Train B Filters	A022	119.0	238.4	241.4	3.0
	A023	119.4			
Train B Probe	11B	117490.9	117490.9	117491.0	0.1
Train B O-Rings	11B	4229.5	4229.5	4230.0	0.5
Background Filter			0.0	0.0	

**Placed in
Dessicator on:**

Train A Filters - First Hour	121.7	6/19 14:15	121.6	6/25 15:11		
Train A Filters - Remainder	240.2	6/19 14:16	240.2	6/25 15:11		
Train A Probe	117037.0	6/19 14:20	117037.1	6/25 15:05		
Train A O-Rings	3418.6	6/19 14:13	3418.8	6/25 15:07		
Train B Filters	241.2	6/19 14:16	241.4	6/25 15:11		
Train B Probe	117491.0	6/19 14:20	117491.0	6/25 15:05		
Train B O-Rings	4230.2	6/19 14:13	4230.0	6/25 15:08		
Background Filter						

1st hour Sub-Total, mg:	3.1
Remainder Sub-Total, mg:	1.9
Train 1 Aggregate, mg:	5.0
Train 2 Aggregate, mg:	3.6
Ambient Aggregate, mg:	0.0

Form P407 ASTM E2780 Run Notes

Client: MF Fire Job Number: 20-606 Tracking #: 74
 Model: Nova 2 Run Number: 3 Test Date: 6/16/20

Test Control Settings

Primary Air Setting(s): N/A - Fixed
 Targeted Burn Category: N/A - Single BR

Preburn Notes

Time	Notes
	-None-

Test Notes

Test Burn Start Time: 12:42 Test Fuel Loaded by: 35 seconds
 Door Closed: 3:20 seconds Air Control Set at: N/A seconds
 Other Loading Notes: Fan on high

Time	Notes
60:00	Changed filter A

Test Burn End Time: 15:26


Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO₂ (%): 16.90 CO (%): 4.18
 Mid Gas CO₂ (%): 10.00 CO (%): 2.51

Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	10:43	10:46	10:45	6/17 9:18	6/17 9:23	6/17 9:20
CO ₂	0.00	9.99	16.90	0.02	9.94	16.80
CO	0.000	2.433	4.180	0.007	2.489	4.144

Flue Gas Probe Leak Check: Initial: No Leakage Final: No Leakage

Technician Signature: 

Date: 7/1/2020

Form P407 ASTM E2780 Run Notes

Client: MF Fire Job Number: 20-606 Tracking #: 74
Model: Nova 2 Run Number: 3 Test Date: 6/16/20




Test Fuel Front View



Test Fuel Iso View



Test Fuel Loaded in Stove

Technician Signature: 

Date: 7/1/2020

WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515



Run 4 Data Summary

Client:	MF Fire
Model:	Nova 2
Job #:	20-606
Tracking #:	74
Test Date:	6/17/2020



Technician Signature

7/7/2020
Date

TEST RESULTS - ASTM E2780 / ASTM E2515

Client: MF Fire

Model: Nova 2

Run #: 4

Job #: 20-606

Tracking #: 74

Technician: A Kravitz

Date: 6/17/2020

Burn Rate (kg/hr):	2.70
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	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft ³)	0.000	16.568	16.481	7.789
Average Gas Velocity in Dilution Tunnel (ft/sec)	15.2			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	9785.5			
Average Gas Meter Temperature (°F)	72.9	87.9	89.4	81.6
Total Sample Volume (dscf)	0.000	16.013	15.950	7.614
Average Tunnel Temperature (°F)	109.1			
Total Time of Test (min)	126			
Total Particulate Catch (mg)	0.0	2.9	2.9	1.8
Particulate Concentration, dry-standard (g/dscf)	0.0000000	0.0001811	0.0001818	0.0002364
Total PM Emissions (g)	0.00	3.72	3.74	2.31
Particulate Emission Rate (g/hr)	0.00	1.77	1.78	2.31
Emissions Factor (g/kg)	-	0.66	0.66	-
Difference from Average Total Particulate Emissions (g)	-	0.01	0.01	-
Difference from Average Emissions Factor (g/kg)	-	0.00	0.00	-

Final Average Results	
Total Particulate Emissions (g)	3.73
Particulate Emission Rate (g/hr)	1.78
Emissions Factor (g/kg)	0.66
HHV Efficiency (%)	75.3%
LHV Efficiency (%)	81.4%
CO Emissions (g/min)	0.95

Quality Checks	Requirement	Observed	Result
Dual Train Precision	Each train within 7.5% of average emissions (in grams), or emission factors within 0.5 g/kg	See Above	OK
Filter Temps	<90 °F	78.0	OK
Face Velocity	< 30 ft/min	7.4	OK
Leakage Rate	Less than 4% of average sample rate	0 cfm	OK
Ambient Temp	55-90 °F	Min: 70 / Max: 76	OK
Negative Probe Weight Evaluation	<5% of Total Catch	Probe Catch Not Negative	OK
Pro-Rate Variation	90% of readings between 90-110%; none greater than 120% or less than 80%	See Data Tabs	OK
Stove Surface ΔT	<126°F	18.0	OK

B415.1 Efficiency Results

Manufacturer: MF Fire
Model: Nova 2
Date: 06/17/20
Run: 4
Control #: 20-606
Test Duration: 126
Output Category: 4

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	75.3%	81.4%
Combustion Efficiency	98.7%	98.7%
Heat Transfer Efficiency	76.3%	82.5%

Output Rate (kJ/h)	40,098	38,037	(Btu/h)
Burn Rate (kg/h)	2.69	5.92	(lb/h)
Input (kJ/h)	53,250	50,514	(Btu/h)

Test Load Weight (dry kg)	5.64	12.44	dry lb
MC wet (%)	18.15		
MC dry (%)	22.17		
Particulate (g)	3.73		
CO (g)	119		
Test Duration (h)	2.10		

Emissions	Particulate	CO
g/MJ Output	0.04	1.42
g/kg Dry Fuel	0.66	21.12
g/h	1.78	56.78
g/min	0.03	0.95
lb/MM Btu Output	0.10	3.29

Air/Fuel Ratio (A/F)	10.77
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VERSION:

2.2

12/14/2009

WOODSTOVE FUEL DATA - ASTM E2780

Client: MF Fire
 Model: Nova 2
 Run #: 4

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/17/2020

Preburn Fuel Information						
Size	Length (in)	Moisture Content (% DB)		Size	Length (in)	Moisture Content (% DB)
2x4	16.00			2x4	10.00	
2x4	16.00			2x4	10.00	
2x4	16.00			2x4	10.00	
2x4	16.00					
2x4	10.00					
2x4	10.00					
2x4	10.00					
2x4	10.00					
Total Fuel Weight (lbs):				Average Moisture (%DB):		#DIV/0!

Firebox Volume (ft³): 2.4
 Total 2x4 Crib Weight, with spacers (lbs): 6.40
 Total 4x4 Crib Weight, with spacers (lbs): 8.82
 Total Wet Fuel Weight, with spacers (lbs): 15.22

Coal Bed Range (20-25%):
 Min (lbs): 3.04
 Max (lbs): 3.81

Test Fuel Information						
Size	Length (in)	Weight (lbs)	Moisture Content (%DB)			Dry Weight (lbs)
4x4	16.00	3.97	24.7	22.0	22.7	3.22
4x4	16.00	4.28	24.4	24.9	22.8	3.45
2x4	16.00	1.73	23.8	23.2	19.7	1.42
2x4	16.00	1.77	18.6	19.0	19.7	1.49
2x4	16.00	1.68	21.3	22.3	23.5	1.37
Total Dry Weight, no spacers (lbs):						10.95
Total Dry Weight, with spacers (lbs):						12.51

Spacer Moisture Readings (%DB)						
14.5						

Quality Checks	Requirement	Observed	Result
Fuel Density	25 - 36 (lbs/ft ³ , DB)	29.4	OK
Loading Density	6.3 - 7.7 (lbs/ft ³ , WB)	6.95	OK
2x4 Fuel Mix	35 - 65 % of total weight	42%	OK

DILUTION TUNNEL & MISC. DATA - ASTM E2780 / E2515

Client: MF Fire	Job #: 20-606
Model: Nova 2	Tracking #: 74
Run #: 4	Technician: A Kravitz
Test Start Time: 13:42	Date: 6/17/2020

Total Sampling Time (min): 126		Pre-Test	Post Test	Avg.
Recording Interval (min): 1	Barometric Pressure (in. Hg): 29.96	29.96	29.94	29.95
Meter Box γ Factor: 0.998 (A)	Relative Humidity (%): 45.5	45.5	29.4	
Meter Box γ Factor: 1.002 (B)	Room Air Velocity (ft/min): 0	0	0	
Meter Box γ Factor: 1.000 (Ambient)	Scale Audit (lbs): 10.0	10.0	10.0	
	Ambient Sample Volume:			ft ³

Induced Draft Check (in. H₂O): 0
 Smoke Capture Check (%): 100%
 Date Flue Pipe Last Cleaned: 6/4/2020

Sample Train Post-Test Leak Checks

(A)	0.000	cfm @	-7	in. Hg
(B)	0.000	cfm @	-11	in. Hg
(Ambient)		cfm @		in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H ₂ O)	Temp (°F)
1	0.030	105
2	0.064	105
3	0.066	105
4	0.040	105
5	0.038	105
6	0.032	105
7	0.066	105
8	0.040	105
Center	0.080	105

Dilution Tunnel H ₂ O:	2.00	percent
Tunnel Diameter:	6	inches
Pitot Tube Cp:	0.99	[unitless]
Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Tunnel Area:	0.1963	ft ²
V _{strav} :	15.20	ft/sec
V _{scent} :	19.38	ft/sec
F _p :	0.784	[ratio]
Initial Tunnel Flow:	158.5	scf/min

Static Pressure: -0.180 in. H₂O

TEST FUEL PROPERTIES

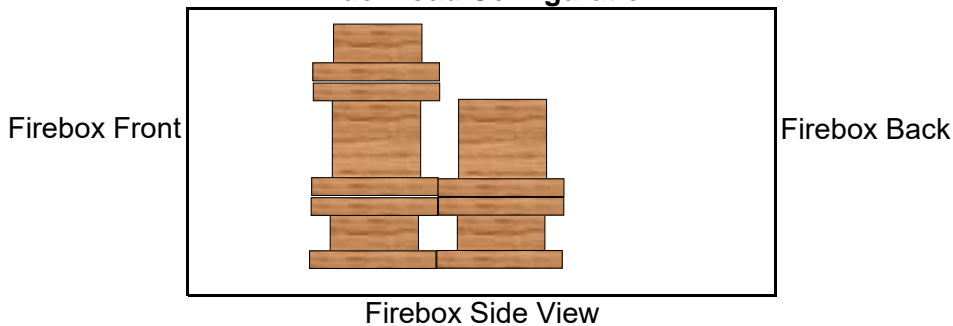
Default Fuel Values

Fuel Type:	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

Actual Fuel Used Properties

Fuel Type:	D. Fir
HHV (kJ/kg)	19,810
%C	48.73
%H	6.87
%O	43.9
%Ash	0.5
MC (%DB)	22.2

Fuel Load Configuration



WOODSTOVE PREBURN DATA - ASTM E2780

Client: MF Fire
 Model: Nova 2
 Run #: 4

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/17/2020

Recording Interval (min): 1
 Run Time (min): 120

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	Temperatures (°F)							Flue	Ambient
			FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average			
0	19.6	-0.087	251	213	201	557	129	270.2	437	68	
1	19.4	-0.079	252	212	197	534	130	265.0	419	68	
2	19.3	-0.070	252	215	194	513	132	261.2	408	68	
3	19.1	-0.075	253	218	191	494	133	257.8	401	68	
4	19.1	-0.059	253	215	188	473	135	252.8	384	68	
5	19.0	-0.071	255	222	185	455	137	250.8	351	68	
6	18.9	-0.067	255	219	182	439	138	246.6	346	68	
7	18.8	-0.064	255	219	179	425	139	243.4	340	68	
8	18.8	-0.061	255	224	176	411	140	241.2	334	67	
9	18.7	-0.073	255	224	174	400	142	239.0	329	67	
10	18.6	-0.063	254	224	171	388	142	235.8	322	67	
11	18.5	-0.064	253	222	168	378	144	233.0	313	67	
12	18.4	-0.067	253	224	166	368	145	231.2	302	67	
13	18.3	-0.063	252	216	165	360	147	228.0	302	67	
14	18.1	-0.060	251	223	163	356	148	228.2	304	68	
15	20.4	-0.064	251	218	161	354	150	226.8	323	68	
16	17.9	-0.077	249	218	158	369	151	229.0	359	67	
17	17.8	-0.071	248	215	156	369	152	228.0	356	67	
18	17.6	-0.074	246	212	154	370	152	226.8	346	68	
19	17.5	-0.073	245	215	153	372	153	227.6	341	67	
20	17.4	-0.069	244	214	151	372	154	227.0	337	67	
21	17.3	-0.069	243	213	150	368	155	225.8	334	67	
22	17.2	-0.069	242	211	149	367	156	225.0	330	67	
23	17.1	-0.066	241	209	147	365	157	223.8	329	67	
24	17.0	-0.070	239	209	146	362	158	222.8	328	67	
25	16.8	-0.068	238	206	145	361	158	221.6	327	67	
26	16.8	-0.065	237	210	144	358	159	221.6	324	67	
27	16.6	-0.066	236	206	143	357	159	220.2	323	67	
28	16.5	-0.063	235	208	142	354	160	219.8	323	67	
29	16.3	-0.065	234	207	142	352	161	219.2	323	67	
30	16.3	-0.067	234	208	141	351	162	219.2	322	67	
31	16.1	-0.073	233	206	141	352	163	219.0	326	68	
32	16.0	-0.066	232	206	141	359	164	220.4	342	68	
33	15.8	-0.073	231	205	140	370	165	222.2	354	67	
34	15.6	-0.080	230	203	139	392	165	225.8	365	67	
35	15.5	-0.074	229	203	138	418	165	230.6	378	67	
36	15.4	-0.082	229	204	138	445	167	236.6	390	68	
37	15.1	-0.086	228	206	138	474	168	242.8	403	68	
38	14.9	-0.077	228	206	137	499	169	247.8	414	68	
39	14.7	-0.079	228	207	137	513	169	250.8	415	68	
40	14.6	-0.082	228	207	137	520	170	252.4	410	68	
41	14.4	-0.077	229	210	138	522	171	254.0	406	68	
42	14.3	-0.074	228	210	137	527	171	254.6	404	68	
43	14.1	-0.078	228	210	138	528	171	255.0	402	67	
44	13.9	-0.083	229	213	138	527	172	255.8	400	68	

WOODSTOVE PREBURN DATA - ASTM E2780

Client: MF Fire
 Model: Nova 2
 Run #: 4

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/17/2020

Recording Interval (min): 1
 Run Time (min): 120

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	Temperatures (°F)							Flue	Ambient
			FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average			
45	13.9	-0.079	230	213	138	527	172	256.0	400	68	
46	13.8	-0.077	229	213	138	531	172	256.6	399	67	
47	13.5	-0.078	230	216	138	530	174	257.6	399	68	
48	13.5	-0.078	231	215	138	532	174	258.0	397	68	
49	13.4	-0.071	231	218	139	532	174	258.8	397	68	
50	13.2	-0.074	233	221	139	532	175	260.0	396	68	
51	13.0	-0.077	234	220	140	534	175	260.6	396	68	
52	12.9	-0.082	235	222	140	534	175	261.2	398	68	
53	12.7	-0.081	236	222	140	539	176	262.6	404	68	
54	12.6	-0.081	236	221	141	545	177	264.0	409	68	
55	12.3	-0.069	236	222	141	553	176	265.6	413	68	
56	12.3	-0.079	238	224	141	562	177	268.4	420	68	
57	12.1	-0.088	238	225	142	574	177	271.2	424	68	
58	11.9	-0.081	238	225	142	589	177	274.2	432	68	
59	11.7	-0.083	238	224	142	605	176	277.0	438	68	
60	11.6	-0.090	240	228	143	617	177	281.0	443	68	
61	11.3	-0.083	241	231	144	626	177	283.8	460	68	
62	11.1	-0.088	244	229	146	637	178	286.8	456	68	
63	10.9	-0.083	245	234	148	645	179	290.2	453	68	
64	10.7	-0.088	248	232	150	650	179	291.8	450	68	
65	10.6	-0.079	249	232	152	649	179	292.2	446	68	
66	10.4	-0.079	251	239	152	651	180	294.6	444	68	
67	10.1	-0.081	254	240	154	647	180	295.0	442	68	
68	10.0	-0.081	256	243	156	646	181	296.4	441	68	
69	9.8	-0.078	258	246	157	646	181	297.6	438	68	
70	9.7	-0.088	262	248	159	641	181	298.2	439	69	
71	9.5	-0.081	264	250	160	640	182	299.2	438	69	
72	9.3	-0.086	266	252	162	639	183	300.4	438	69	
73	9.1	-0.079	269	255	164	640	183	302.2	439	69	
74	8.9	-0.086	272	257	165	641	184	303.8	442	69	
75	8.7	-0.085	275	259	167	645	185	306.2	444	69	
76	8.6	-0.091	277	260	168	648	185	307.6	449	69	
77	8.4	-0.086	279	259	169	656	185	309.6	450	69	
78	8.2	-0.083	281	265	170	660	186	312.4	450	69	
79	8.1	-0.085	283	263	172	665	187	314.0	452	69	
80	7.9	-0.080	286	266	173	669	187	316.2	453	69	
81	7.7	-0.081	289	270	175	671	187	318.4	452	69	
82	7.6	-0.083	292	271	177	672	188	320.0	454	69	
83	7.4	-0.088	294	272	179	672	189	321.2	454	69	
84	7.3	-0.082	296	271	180	676	190	322.6	455	69	
85	7.1	-0.084	298	272	181	678	190	323.8	458	69	
86	7.0	-0.082	301	274	182	679	191	325.4	460	70	
87	6.8	-0.092	303	278	183	681	192	327.4	464	69	
88	6.7	-0.092	305	278	185	685	193	329.2	465	69	
89	6.5	-0.087	307	281	186	687	194	331.0	465	69	

WOODSTOVE PREBURN DATA - ASTM E2780

Client: MF Fire
 Model: Nova 2
 Run #: 4

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/17/2020

Recording Interval (min): 1
 Run Time (min): 120

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	Temperatures (°F)							Flue	Ambient
			FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average			
90	6.4	-0.085	309	282	187	688	195	332.2	464	69	
91	6.2	-0.085	311	283	189	687	196	333.2	462	69	
92	6.0	-0.083	312	284	190	686	197	333.8	460	69	
93	6.0	-0.084	313	283	192	684	197	333.8	459	69	
94	5.9	-0.087	315	289	194	680	199	335.4	456	69	
95	5.7	-0.085	317	287	196	677	199	335.2	453	69	
96	5.6	-0.081	318	286	197	674	200	335.0	450	69	
97	5.5	-0.069	319	290	199	670	202	336.0	447	69	
98	5.4	-0.081	321	291	200	666	203	336.2	443	70	
99	5.2	-0.074	322	291	201	662	204	336.0	440	70	
100	5.2	-0.084	322	293	203	659	206	336.6	437	70	
101	5.1	-0.082	324	294	203	655	207	336.6	435	70	
102	4.9	-0.080	325	296	205	651	208	337.0	432	70	
103	4.9	-0.087	326	297	206	645	210	336.8	428	70	
104	4.8	-0.074	327	297	207	638	210	335.8	424	70	
105	4.7	-0.081	329	299	208	631	211	335.6	421	70	
106	4.6	-0.081	330	300	210	624	213	335.4	417	70	
107	4.5	-0.078	330	296	210	618	214	333.6	412	70	
108	4.5	-0.073	331	299	212	608	216	333.2	408	70	
109	4.4	-0.076	332	300	213	599	217	332.2	403	70	
110	4.4	-0.088	333	300	213	595	219	332.0	400	70	
111	4.3	-0.076	334	302	213	586	220	331.0	397	70	
112	4.3	-0.082	335	303	213	579	222	330.4	394	70	
113	4.2	-0.079	335	300	213	570	223	328.2	392	71	
114	4.1	-0.075	336	300	214	561	225	327.2	390	70	
115	4.1	-0.074	336	304	214	552	227	326.6	388	70	
116	4.0	-0.072	336	302	215	544	228	325.0	386	71	
117	4.0	-0.065	336	294	215	536	229	322.0	383	70	
118	4.0	-0.074	337	302	215	527	231	322.4	381	70	
119	3.9	-0.076	337	301	215	521	232	321.2	379	70	
120	3.9	-0.070	337	301	214	514	233	319.8	376	70	

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF FireJob #: 20-606Model: Nova 2Tracking #: 74Run #: 4Technician: A KravitzDate: 6/17/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.082	0.02	76	-0.06		15.2		103	373	72	70
1	0.119	0.119	0.075	1.59	76	-0.88	96	15.1	-0.1	118	383	73	71
2	0.244	0.125	0.076	1.68	76	-0.69	101	14.9	-0.2	126	395	74	70
3	0.368	0.124	0.072	1.71	76	-0.74	103	14.6	-0.3	127	429	75	70
4	0.499	0.131	0.067	1.71	76	-0.68	112	14.5	-0.1	116	415	74	70
5	0.628	0.129	0.075	1.68	76	-0.92	104	14.2	-0.3	112	405	74	70
6	0.753	0.125	0.078	1.73	76	-0.91	98	14.2	0	110	400	74	70
7	0.881	0.128	0.088	1.72	76	-1.04	95	14.1	-0.1	109	401	74	70
8	1.012	0.131	0.074	1.72	76	-0.96	105	13.9	-0.2	108	400	74	70
9	1.139	0.127	0.087	1.74	76	-0.71	94	13.8	-0.1	108	402	74	70
10	1.267	0.128	0.077	1.73	77	-0.84	101	13.6	-0.2	108	402	74	70
11	1.398	0.131	0.091	1.75	77	-0.67	95	13.5	-0.1	108	406	74	70
12	1.526	0.128	0.072	1.75	77	-0.7	104	13.3	-0.2	108	413	74	70
13	1.656	0.130	0.081	1.75	77	-1.02	100	13.1	-0.2	108	420	74	70
14	1.787	0.131	0.074	1.75	77	-0.68	105	12.8	-0.3	110	436	75	70
15	1.915	0.128	0.089	1.77	78	-0.66	94	12.7	-0.1	111	452	75	70
16	2.046	0.131	0.086	1.78	78	-0.73	98	12.4	-0.3	110	455	74	70
17	2.178	0.132	0.084	1.77	78	-0.93	100	12.2	-0.2	111	451	74	70
18	2.307	0.129	0.071	1.79	78	-1.02	106	12.1	-0.1	112	454	74	70
19	2.438	0.131	0.070	1.80	78	-0.95	108	11.9	-0.2	112	452	74	70
20	2.570	0.132	0.068	1.79	79	-0.7	111	11.8	-0.1	112	450	74	70
21	2.701	0.131	0.089	1.82	79	-0.92	96	11.6	-0.2	112	451	74	71
22	2.831	0.130	0.083	1.83	79	-0.95	99	11.4	-0.2	111	456	75	71
23	2.963	0.132	0.077	1.71	80	-0.89	104	11.1	-0.3	111	461	75	71
24	3.090	0.127	0.070	1.72	80	-1.05	105	10.9	-0.2	112	466	75	71
25	3.218	0.128	0.084	1.71	80	-0.67	96	10.7	-0.2	111	467	74	71
26	3.348	0.130	0.088	1.74	80	-0.86	96	10.6	-0.1	112	465	74	71
27	3.475	0.127	0.093	1.72	81	-0.91	91	10.4	-0.2	111	464	75	71
28	3.603	0.128	0.086	1.73	81	-0.97	95	10.2	-0.2	112	463	75	71
29	3.735	0.132	0.083	1.73	81	-1.02	100	10.0	-0.2	112	464	75	71
30	3.863	0.128	0.083	1.73	81	-0.63	97	9.8	-0.2	113	466	75	72
31	3.990	0.127	0.077	1.74	82	-0.74	100	9.6	-0.2	113	469	75	72

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF FireJob #: 20-606Model: Nova 2Tracking #: 74Run #: 4Technician: A KravitzDate: 6/17/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
32	4.123	0.133	0.083	1.74	82	-0.72	100	9.3	-0.3	113	468	75	72
33	4.251	0.128	0.087	1.75	82	-0.66	94	9.2	-0.1	113	472	75	72
34	4.378	0.127	0.087	1.73	82	-0.92	94	9.0	-0.2	113	474	75	72
35	4.512	0.134	0.089	1.76	83	-0.82	98	8.8	-0.2	113	477	75	72
36	4.641	0.129	0.080	1.75	83	-0.6	99	8.6	-0.2	113	481	75	72
37	4.768	0.127	0.081	1.76	83	-0.8	97	8.4	-0.2	114	485	75	72
38	4.902	0.134	0.086	1.77	84	-0.93	99	8.1	-0.3	114	489	76	72
39	5.032	0.130	0.074	1.77	84	-0.93	104	7.8	-0.3	114	490	75	72
40	5.160	0.128	0.083	1.76	84	-0.97	96	7.7	-0.1	115	490	76	72
41	5.294	0.134	0.086	1.77	84	-0.9	99	7.4	-0.3	115	490	76	72
42	5.424	0.130	0.081	1.77	85	-0.71	99	7.3	-0.1	116	490	76	72
43	5.553	0.129	0.086	1.75	85	-0.8	95	7.1	-0.2	116	488	76	72
44	5.687	0.134	0.080	1.76	85	-1	103	6.9	-0.2	116	487	76	72
45	5.817	0.130	0.084	1.78	85	-0.78	97	6.7	-0.2	115	486	75	72
46	5.947	0.130	0.074	1.78	86	-1.01	103	6.5	-0.2	116	487	75	72
47	6.082	0.135	0.079	1.78	86	-0.63	104	6.4	-0.1	115	487	75	73
48	6.211	0.129	0.080	1.78	86	-0.95	99	6.3	-0.1	116	487	75	73
49	6.343	0.132	0.085	1.79	86	-0.9	98	6.1	-0.2	115	486	76	73
50	6.476	0.133	0.064	1.77	87	-0.96	114	5.9	-0.2	116	485	76	73
51	6.607	0.131	0.077	1.79	87	-0.92	102	5.7	-0.2	115	485	76	73
52	6.739	0.132	0.081	1.81	87	-0.99	100	5.6	-0.1	115	483	76	72
53	6.872	0.133	0.078	1.80	87	-0.58	103	5.4	-0.2	115	479	76	72
54	7.004	0.132	0.076	1.80	88	-0.89	103	5.3	-0.1	114	473	76	72
55	7.135	0.131	0.067	1.77	88	-0.93	109	5.1	-0.2	113	468	75	72
56	7.267	0.132	0.081	1.74	88	-0.84	100	5.0	-0.1	113	462	75	73
57	7.396	0.129	0.081	1.73	88	-0.74	97	4.7	-0.3	112	458	75	73
58	7.526	0.130	0.081	1.78	89	-0.82	98	4.6	-0.1	113	454	76	72
59	7.659	0.133	0.087	1.76	89	-0.91	97	4.6	0	113	449	76	72
60	7.789	0.130	0.077	1.76	89	-0.59	101	4.5	-0.1	113	444	76	73
61	7.920	0.131	0.084	1.76	89	-0.71	97	4.4	-0.1	112	440	76	72
62	8.054	0.134	0.080	1.78	89	-0.84	102	4.3	-0.1	111	434	76	73
63	8.182	0.128	0.081	1.78	90	-0.65	96	4.2	-0.1	111	431	76	73

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF FireJob #: 20-606Model: Nova 2Tracking #: 74Run #: 4Technician: A KravitzDate: 6/17/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
64	8.314	0.132	0.076	1.75	90	-0.9	102	4.1	-0.1	111	429	76	73
65	8.448	0.134	0.078	1.77	90	-0.87	103	4.0	-0.1	110	425	76	73
66	8.576	0.128	0.079	1.75	90	-0.76	97	3.9	-0.1	110	423	76	74
67	8.710	0.134	0.084	1.77	91	-0.72	99	3.9	0	110	420	76	74
68	8.842	0.132	0.092	1.77	91	-0.73	93	3.7	-0.2	109	416	76	74
69	8.970	0.128	0.071	1.78	91	-0.64	102	3.6	-0.1	108	414	75	73
70	9.106	0.136	0.081	1.78	91	-0.95	102	3.5	-0.1	109	411	75	72
71	9.237	0.131	0.085	1.80	91	-0.82	96	3.4	-0.1	109	408	75	74
72	9.367	0.130	0.073	1.78	91	-0.78	103	3.3	-0.1	108	407	75	72
73	9.502	0.135	0.079	1.76	91	-0.96	102	3.2	-0.1	109	405	75	74
74	9.632	0.130	0.075	1.79	92	-0.69	101	3.2	0	109	403	75	74
75	9.764	0.132	0.081	1.79	92	-0.57	99	3.1	-0.1	108	402	75	73
76	9.899	0.135	0.076	1.79	92	-0.89	104	3.0	-0.1	108	400	75	74
77	10.030	0.131	0.085	1.80	92	-0.9	95	2.9	-0.1	107	399	75	73
78	10.161	0.131	0.091	1.78	92	-0.69	92	2.8	-0.1	107	398	75	74
79	10.296	0.135	0.077	1.77	92	-0.74	103	2.8	0	107	397	75	74
80	10.427	0.131	0.062	1.80	92	-0.69	112	2.7	-0.1	107	396	75	74
81	10.559	0.132	0.068	1.78	92	-0.87	107	2.6	-0.1	106	394	75	74
82	10.694	0.135	0.089	1.81	93	-0.6	96	2.5	-0.1	105	393	75	74
83	10.823	0.129	0.085	1.81	93	-0.65	94	2.4	-0.1	105	393	75	74
84	10.958	0.135	0.079	1.80	93	-0.86	102	2.3	-0.1	105	391	75	74
85	11.091	0.133	0.069	1.78	93	-0.8	107	2.3	0	105	391	75	74
86	11.222	0.131	0.078	1.80	93	-0.72	99	2.2	-0.1	105	391	75	74
87	11.358	0.136	0.072	1.81	93	-0.75	107	2.1	-0.1	105	391	75	74
88	11.488	0.130	0.088	1.80	93	-0.68	93	2.0	-0.1	105	390	75	75
89	11.621	0.133	0.080	1.81	93	-1.02	100	1.9	-0.1	106	389	75	74
90	11.756	0.135	0.089	1.79	94	-0.79	96	1.9	0	106	390	75	74
91	11.888	0.132	0.081	1.80	94	-0.84	98	1.8	-0.1	106	389	75	74
92	12.020	0.132	0.076	1.80	94	-0.83	101	1.7	-0.1	106	388	75	74
93	12.156	0.136	0.083	1.76	94	-0.79	100	1.6	-0.1	106	388	75	74
94	12.286	0.130	0.091	1.78	94	-0.7	91	1.6	0	106	386	75	74
95	12.420	0.134	0.071	1.79	94	-0.79	106	1.5	-0.1	105	386	75	75

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF FireJob #: 20-606Model: Nova 2Tracking #: 74Run #: 4Technician: A KravitzDate: 6/17/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
96	12.555	0.135	0.079	1.79	94	-1.01	102	1.5	0	105	385	75	74
97	12.684	0.129	0.087	1.82	94	-0.6	92	1.4	-0.1	105	382	75	74
98	12.822	0.138	0.085	1.79	94	-0.72	100	1.4	0	105	382	75	74
99	12.953	0.131	0.079	1.80	94	-0.79	98	1.3	-0.1	104	380	75	74
100	13.086	0.133	0.079	1.78	95	-1.02	100	1.2	-0.1	104	381	75	74
101	13.221	0.135	0.070	1.79	95	-0.8	107	1.2	0	103	381	75	75
102	13.354	0.133	0.080	1.81	95	-0.65	99	1.1	-0.1	103	382	75	75
103	13.486	0.132	0.076	1.78	95	-0.74	101	1.0	-0.1	104	380	75	74
104	13.623	0.137	0.079	1.81	95	-0.76	103	1.0	0	104	380	75	75
105	13.753	0.130	0.076	1.83	95	-0.77	99	0.9	-0.1	104	379	76	74
106	13.888	0.135	0.081	1.81	95	-0.8	100	0.9	0	104	379	76	75
107	14.023	0.135	0.071	1.82	95	-0.58	107	0.8	-0.1	104	378	76	75
108	14.154	0.131	0.086	1.80	95	-0.55	94	0.8	0	104	376	76	75
109	14.291	0.137	0.079	1.82	95	-0.95	103	0.7	-0.1	104	375	76	75
110	14.423	0.132	0.083	1.82	96	-1	96	0.7	0	104	373	76	76
111	14.556	0.133	0.066	1.83	96	-0.69	109	0.6	-0.1	104	371	76	75
112	14.692	0.136	0.088	1.81	96	-0.95	96	0.6	0	103	369	76	76
113	14.825	0.133	0.073	1.83	96	-0.77	103	0.6	0	103	368	76	76
114	14.958	0.133	0.079	1.80	96	-0.95	99	0.5	-0.1	102	366	76	75
115	15.095	0.137	0.085	1.83	96	-0.61	99	0.5	0	103	365	76	75
116	15.224	0.129	0.081	1.81	96	-0.68	95	0.4	-0.1	103	364	76	75
117	15.362	0.138	0.079	1.82	96	-0.95	103	0.4	0	103	362	76	75
118	15.494	0.132	0.081	1.81	96	-0.92	98	0.3	-0.1	103	361	76	76
119	15.628	0.134	0.079	1.82	96	-0.97	100	0.3	0	102	359	76	76
120	15.764	0.136	0.076	1.83	96	-0.68	104	0.3	0	102	357	76	75
121	15.897	0.133	0.067	1.82	96	-0.67	108	0.2	-0.1	102	356	76	75
122	16.030	0.133	0.072	1.80	97	-0.96	104	0.2	0	102	355	76	75
123	16.167	0.137	0.079	1.83	97	-0.92	102	0.2	0	102	354	76	76
124	16.298	0.131	0.084	1.83	97	-1.1	95	0.1	-0.1	101	354	76	75
125	16.433	0.135	0.084	1.80	97	-0.77	98	0.1	0	101	353	76	76
126	16.568	0.135	0.082	1.83	97	-0.95	99	0.0	-0.1	101	353	76	76

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 4

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/17/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: <u>MF Fire</u>	Job #: <u>20-606</u>
Model: <u>Nova 2</u>	Tracking #: <u>74</u>
Run #: <u>4</u>	Technician: <u>A Kravitz</u>
	Date: <u>6/17/2020</u>

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
Avg/Tot	16.568	0.131	0.080	1.76	88	-0.81	100			109	420	75	72.9

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 4

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/17/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
0	0.000		0.00	77	-1		73	0.000	8.02	0.07
1	0.122	0.122	1.75	77	-2.89	99	74	-0.060	7.76	0.07
2	0.248	0.126	1.74	77	0	102	74	-0.080	2.79	0.32
3	0.374	0.126	1.75	77	-3.23	105	75	-0.090	5.48	0.21
4	0.503	0.129	1.74	77	-3.3	111	74	-0.080	10.66	0.18
5	0.630	0.127	1.74	77	0	103	74	-0.080	6.45	0.06
6	0.757	0.127	1.74	77	0	100	74	-0.080	6.41	0.09
7	0.886	0.129	1.75	77	0	96	74	-0.080	7.18	0.07
8	1.013	0.127	1.74	77	-3.31	103	74	-0.070	8.40	0.08
9	1.139	0.126	1.74	77	-0.18	94	74	-0.080	7.75	0.10
10	1.269	0.130	1.75	77	-2.91	103	74	-0.080	7.94	0.10
11	1.398	0.129	1.75	77	0	94	74	-0.070	8.83	0.09
12	1.522	0.124	1.74	78	-0.71	102	74	-0.070	8.66	0.14
13	1.650	0.128	1.74	78	-3.2	99	75	-0.080	8.51	0.15
14	1.780	0.130	1.75	78	-3.31	105	75	-0.080	11.99	0.11
15	1.907	0.127	1.74	78	-2.29	94	75	-0.090	14.89	1.14
16	2.033	0.126	1.74	78	-2.15	95	75	-0.090	13.74	0.44
17	2.163	0.130	1.75	79	0	99	75	-0.080	10.66	0.07
18	2.291	0.128	1.76	79	-3.25	106	75	-0.090	10.91	0.09
19	2.418	0.127	1.76	79	-0.14	106	75	-0.070	11.20	0.09
20	2.548	0.130	1.75	79	0	110	75	-0.080	10.97	0.09
21	2.675	0.127	1.76	80	0	94	75	-0.080	11.83	0.07
22	2.802	0.127	1.76	80	0	97	75	-0.080	12.69	0.10
23	2.932	0.130	1.76	80	-3.19	103	75	-0.080	13.50	0.17
24	3.061	0.129	1.76	80	-0.34	107	75	-0.080	13.98	0.25
25	3.187	0.126	1.75	81	-0.25	95	75	-0.080	13.99	0.31
26	3.317	0.130	1.77	81	0	96	75	-0.080	12.85	0.10
27	3.448	0.131	1.76	81	-2.9	94	75	-0.080	12.87	0.02
28	3.574	0.126	1.78	82	-3.22	94	75	-0.080	13.18	0.08
29	3.703	0.129	1.76	82	-3.33	98	75	-0.090	13.22	0.13
30	3.835	0.132	1.77	82	-2.68	100	75	-0.080	13.95	0.12
31	3.962	0.127	1.76	82	0	100	76	-0.090	13.72	0.19

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 4

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/17/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
32	4.090	0.128	1.78	83	-2.7	97	76	-0.090	14.10	0.20
33	4.222	0.132	1.77	83	0	98	76	-0.080	13.99	0.23
34	4.350	0.128	1.78	83	-2.73	95	76	-0.080	14.06	0.24
35	4.478	0.128	1.77	84	-0.3	94	76	-0.090	14.51	0.28
36	4.610	0.132	1.76	84	0	102	76	-0.090	14.49	0.54
37	4.739	0.129	1.77	84	-3.3	99	76	-0.090	14.82	0.61
38	4.868	0.129	1.77	85	-2.35	96	76	-0.090	15.26	1.10
39	4.999	0.131	1.77	85	-0.36	105	76	-0.080	15.19	1.25
40	5.129	0.130	1.78	85	-1.85	99	76	-0.090	15.37	0.78
41	5.258	0.129	1.77	85	-2.73	96	76	-0.080	15.01	0.87
42	5.389	0.131	1.77	86	-3.33	100	76	-0.080	14.91	0.75
43	5.519	0.130	1.77	86	-3.41	97	76	-0.080	14.70	1.10
44	5.648	0.129	1.78	86	-0.47	100	76	-0.090	14.31	0.95
45	5.779	0.131	1.77	87	-2.04	98	76	-0.090	14.51	0.82
46	5.909	0.130	1.78	87	-2.96	104	76	-0.080	14.82	0.64
47	6.039	0.130	1.78	87	0	101	76	-0.080	15.20	1.09
48	6.170	0.131	1.78	87	0	101	76	-0.090	15.52	1.35
49	6.300	0.130	1.78	88	-2.15	97	76	-0.090	15.38	1.29
50	6.430	0.130	1.79	88	0	112	76	-0.090	15.17	1.20
51	6.562	0.132	1.78	88	-0.2	103	76	-0.080	15.20	1.07
52	6.692	0.130	1.79	88	0	99	76	-0.080	15.09	0.81
53	6.822	0.130	1.79	89	-3.34	101	76	-0.080	15.18	0.37
54	6.954	0.132	1.78	89	-2.77	104	76	-0.090	14.79	0.13
55	7.084	0.130	1.79	89	0	109	77	-0.080	14.20	0.06
56	7.214	0.130	1.79	90	-0.85	99	77	-0.080	13.96	0.00
57	7.347	0.133	1.77	90	-3.32	101	77	-0.080	13.70	0.00
58	7.478	0.131	1.79	90	0	99	77	-0.080	13.37	0.01
59	7.607	0.129	1.77	90	-2.83	95	77	-0.080	12.97	0.01
60	7.741	0.134	1.79	90	0	104	77	-0.090	12.54	0.04
61	7.872	0.131	1.79	91	-2.99	97	77	-0.070	12.37	0.04
62	8.001	0.129	1.79	91	-2.42	98	77	-0.080	12.20	0.04
63	8.135	0.134	1.81	91	-1.58	101	77	-0.080	12.12	0.00

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 4

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/17/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
64	8.265	0.130	1.79	91	-2.44	102	77	-0.080	12.14	0.00
65	8.395	0.130	1.80	91	-0.29	100	77	-0.080	11.92	0.00
66	8.530	0.135	1.80	92	-2.64	103	77	-0.080	11.62	0.00
67	8.659	0.129	1.80	92	-2.46	96	77	-0.080	11.67	0.00
68	8.791	0.132	1.80	92	-3.29	93	77	-0.070	11.62	0.01
69	8.925	0.134	1.79	92	0	108	76	-0.070	11.66	0.01
70	9.053	0.128	1.79	92	-0.33	97	76	-0.070	11.22	0.02
71	9.188	0.135	1.80	93	-0.41	99	76	-0.070	11.07	0.00
72	9.319	0.131	1.80	93	-0.19	104	76	-0.080	11.06	0.00
73	9.450	0.131	1.80	93	-2.65	100	76	-0.080	11.07	0.01
74	9.584	0.134	1.80	93	-3.24	105	76	-0.070	10.77	0.03
75	9.715	0.131	1.80	93	-0.89	99	76	-0.070	11.07	0.00
76	9.846	0.131	1.79	94	-1.25	102	76	-0.070	10.69	0.00
77	9.979	0.133	1.80	94	-3.25	97	76	-0.070	10.88	0.00
78	10.111	0.132	1.80	94	-1.54	93	76	-0.080	10.85	0.00
79	10.243	0.132	1.80	94	0	102	76	-0.080	10.79	0.03
80	10.376	0.133	1.80	94	-3.15	114	76	-0.060	10.93	0.00
81	10.508	0.132	1.81	94	-0.45	108	76	-0.080	10.91	0.03
82	10.639	0.131	1.80	94	-0.15	94	76	-0.070	11.01	0.00
83	10.774	0.135	1.80	95	-3.22	98	76	-0.080	10.92	0.01
84	10.904	0.130	1.80	95	-3.24	98	77	-0.080	10.86	0.00
85	11.036	0.132	1.79	95	-2.24	107	77	-0.070	10.90	0.00
86	11.171	0.135	1.79	95	-3.29	103	77	-0.070	10.87	0.04
87	11.301	0.130	1.81	95	0	103	77	-0.070	10.71	0.03
88	11.435	0.134	1.81	95	0	96	77	-0.080	10.55	0.06
89	11.567	0.132	1.81	95	0	99	77	-0.080	10.75	0.03
90	11.698	0.131	1.80	95	-0.19	93	77	-0.080	10.77	0.00
91	11.833	0.135	1.80	96	-1.35	101	77	-0.070	10.52	0.05
92	11.964	0.131	1.80	96	-3.21	101	77	-0.080	10.26	0.02
93	12.096	0.132	1.81	96	-0.29	97	77	-0.060	10.12	0.00
94	12.230	0.134	1.80	96	-0.46	94	77	-0.080	9.94	0.06
95	12.362	0.132	1.81	96	-3.12	105	76	-0.080	9.88	0.04

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 4

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/17/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
96	12.493	0.131	1.82	96	0	99	76	-0.070	10.06	0.03
97	12.628	0.135	1.82	96	-2.72	97	77	-0.080	9.87	0.04
98	12.760	0.132	1.81	97	-0.49	96	76	-0.070	10.07	0.05
99	12.891	0.131	1.81	97	-3.23	99	77	-0.070	9.91	0.05
100	13.027	0.136	1.81	97	0	102	77	-0.070	9.75	0.01
101	13.157	0.130	1.81	97	-2.15	104	77	-0.070	9.76	0.02
102	13.291	0.134	1.81	97	-0.08	100	77	-0.080	9.64	0.06
103	13.424	0.133	1.82	97	-2.23	102	77	-0.070	10.10	0.04
104	13.556	0.132	1.81	97	-0.47	99	77	-0.070	9.84	0.05
105	13.690	0.134	1.81	97	0	103	77	-0.060	9.97	0.01
106	13.822	0.132	1.79	97	-0.92	98	77	-0.070	9.68	0.04
107	13.955	0.133	1.80	98	-3.3	105	77	-0.080	9.60	0.01
108	14.089	0.134	1.80	98	-2.35	97	77	-0.070	8.82	0.03
109	14.221	0.132	1.80	98	-0.57	99	77	-0.070	8.71	0.02
110	14.353	0.132	1.81	98	-0.24	97	77	-0.070	8.56	0.00
111	14.489	0.136	1.82	98	-0.76	112	77	-0.070	8.20	0.07
112	14.619	0.130	1.80	98	-3.08	93	77	-0.080	8.15	0.07
113	14.753	0.134	1.81	98	-2.97	105	77	-0.070	7.96	0.07
114	14.888	0.135	1.82	98	-3.27	101	77	-0.070	7.97	0.07
115	15.018	0.130	1.81	98	-3.12	94	77	-0.080	8.06	0.06
116	15.154	0.136	1.79	98	-2.58	101	77	-0.060	7.97	0.02
117	15.286	0.132	1.82	99	0	99	78	-0.080	8.03	0.03
118	15.418	0.132	1.82	99	-2.44	98	78	-0.070	8.13	0.05
119	15.553	0.135	1.83	99	-0.69	101	78	-0.070	8.03	0.02
120	15.686	0.133	1.81	99	-3.04	102	78	-0.070	7.94	0.00
121	15.817	0.131	1.81	99	0	107	78	-0.070	8.08	0.05
122	15.953	0.136	1.81	99	-3.38	107	78	-0.070	7.99	0.03
123	16.085	0.132	1.81	99	-1.3	99	78	-0.060	8.10	0.03
124	16.217	0.132	1.81	99	-0.55	96	78	-0.060	7.97	0.02
125	16.350	0.133	1.83	99	0	97	78	-0.060	8.06	0.02
126	16.481	0.131	1.81	99	-2.44	96	78	-0.060	8.19	0.04

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 4

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/17/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 4

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/17/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
Avg/Tot	16.481	0.131	1.77	89	-1.55	100	76	-0.077	11.16	0.19

WOODSTOVE SURFACE TEMPERATURE DATA

Client: MF Fire
 Model: Nova 2
 Run #: 4

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/17/2020

Stove ΔT: 18

Temperature Data (°F)							
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
0	337	299	215	504	235	318.0	767
1	337	293	214	490	237	314.2	579
2	337	298	215	476	239	313.0	570
3	337	298	214	478	241	313.6	775
4	336	297	214	472	242	312.2	778
5	336	296	214	464	243	310.6	746
6	336	298	214	457	244	309.8	746
7	335	299	215	453	245	309.4	788
8	334	296	214	453	247	308.8	816
9	333	296	213	450	247	307.8	824
10	332	295	211	451	249	307.6	835
11	331	292	210	452	249	306.8	874
12	329	290	209	451	251	306.0	915
13	328	290	208	453	252	306.2	925
14	327	288	206	475	252	309.6	999
15	325	288	206	504	254	315.4	1048
16	325	285	205	528	255	319.6	1010
17	323	285	203	540	255	321.2	968
18	322	284	203	550	256	323.0	1004
19	321	282	201	557	257	323.6	979
20	320	279	201	563	257	324.0	967
21	319	280	200	570	258	325.4	966
22	318	276	200	582	259	327.0	996
23	317	275	199	595	260	329.2	1014
24	317	273	199	609	260	331.6	1024
25	315	272	199	623	260	333.8	1017
26	315	269	199	630	260	334.6	1006
27	316	270	199	635	261	336.2	1002
28	316	272	199	639	261	337.4	1003
29	316	274	199	645	261	339.0	1016
30	317	272	199	651	262	340.2	1020
31	317	274	199	657	262	341.8	1021
32	317	273	200	665	262	343.4	1024
33	318	275	200	669	262	344.8	1033
34	318	274	200	677	262	346.2	1046
35	319	277	200	684	263	348.6	1058
36	319	275	201	691	263	349.8	1077
37	320	278	202	699	263	352.4	1095
38	320	278	202	707	262	353.8	1114
39	321	278	203	715	263	356.0	1116
40	321	280	204	722	263	358.0	1097
41	323	283	205	727	263	360.2	1103
42	324	282	206	735	263	362.0	1100
43	325	283	207	738	263	363.2	1074
44	326	287	207	740	264	364.8	1061
45	327	286	209	739	263	364.8	1074
46	328	289	209	737	262	365.0	1102
47	330	291	211	735	263	366.0	1103

WOODSTOVE SURFACE TEMPERATURE DATA

Client: MF Fire
 Model: Nova 2
 Run #: 4

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/17/2020

Stove ΔT: 18

Temperature Data (*F)							
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
48	331	290	211	731	263	365.2	1102
49	332	290	212	729	263	365.2	1101
50	333	293	213	728	263	366.0	1102
51	334	290	214	727	263	365.6	1100
52	336	296	215	727	263	367.4	1097
53	337	296	216	727	263	367.8	1091
54	338	294	216	725	263	367.2	1082
55	339	294	217	721	263	366.8	1054
56	340	296	219	717	263	367.0	1036
57	341	297	219	711	263	366.2	1021
58	341	270	223	704	262	360.0	1005
59	342	285	224	697	261	361.8	989
60	344	282	226	691	262	361.0	976
61	344	278	228	682	262	358.8	969
62	346	302	228	675	263	362.8	961
63	347	303	231	667	264	362.4	950
64	349	304	231	659	264	361.4	943
65	350	303	232	651	266	360.4	931
66	351	305	233	645	267	360.2	924
67	352	292	235	637	268	356.8	919
68	352	301	235	632	267	357.4	916
69	353	306	236	627	269	358.2	905
70	355	313	237	620	270	359.0	898
71	355	312	238	613	271	357.8	892
72	356	315	239	607	272	357.8	888
73	357	298	240	602	272	353.8	882
74	358	299	242	598	273	354.0	877
75	358	313	241	595	275	356.4	872
76	359	310	241	591	276	355.4	869
77	360	316	242	586	276	356.0	867
78	361	315	243	582	278	355.8	863
79	361	315	243	580	279	355.6	858
80	361	314	242	578	280	355.0	856
81	361	309	242	575	279	353.2	855
82	360	312	242	573	280	353.4	852
83	361	318	243	571	281	354.8	850
84	361	312	243	570	281	353.4	850
85	362	312	243	569	281	353.4	850
86	362	311	243	569	282	353.4	852
87	361	314	243	567	283	353.6	857
88	362	312	243	565	283	353.0	857
89	362	318	245	563	283	354.2	858
90	363	317	245	561	283	353.8	856
91	364	317	245	560	284	354.0	855
92	363	316	244	557	285	353.0	854
93	364	302	246	554	286	350.4	853
94	364	310	247	552	287	352.0	852
95	365	314	247	548	288	352.4	849

WOODSTOVE SURFACE TEMPERATURE DATA

Client: MF Fire
Model: Nova 2
Run #: 4

Job #: 20-606
Tracking #: 74
Technician: A Kravitz
Date: 6/17/2020

Stove ΔT : 18

Temperature Data (°F)							
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
96	364	313	247	545	289	351.6	846
97	364	312	246	543	289	350.8	843
98	364	318	246	539	291	351.6	836
99	364	315	246	538	291	350.8	834
100	363	313	245	535	291	349.4	832
101	363	313	246	533	291	349.2	830
102	362	309	244	533	291	347.8	827
103	362	312	246	534	291	349.0	824
104	361	316	246	534	293	350.0	822
105	361	315	246	533	293	349.6	823
106	362	315	247	532	293	349.8	822
107	363	313	247	531	293	349.4	820
108	363	317	248	528	293	349.8	820
109	363	318	248	525	294	349.6	819
110	363	305	248	522	294	346.4	816
111	363	313	249	519	295	347.8	813
112	362	316	248	514	296	347.2	805
113	361	316	247	509	297	346.0	794
114	361	314	247	505	298	345.0	787
115	361	317	248	500	299	345.0	783
116	360	316	248	495	299	343.6	780
117	359	312	247	492	299	341.8	777
118	359	314	249	487	300	341.8	774
119	359	315	248	484	301	341.4	770
120	358	309	247	480	300	338.8	766
121	357	311	247	478	302	339.0	765
122	357	315	247	474	303	339.2	762
123	357	314	248	471	303	338.6	760
124	356	314	248	468	304	338.0	758
125	356	315	248	466	304	337.8	755
126	355	311	247	462	305	336.0	752

WOODSTOVE SURFACE TEMPERATURE DATA

Client: MF Fire
 Model: Nova 2
 Run #: 4

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/17/2020

Stove ΔT: 18

Temperature Data (°F)							
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
Average	344	299	226	586	272	345	911

LAB SAMPLE DATA - ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 4

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/17/2020

	Sample ID	Tare, mg	Total, mg	Final, mg	Catch, mg
Train A Filters - First Hour	A024	119.5	119.5	121.3	1.8
Train A Filters - Remainder	A025	120.3	238.8	239.0	0.2
	A026	118.5			
Train A Probe	12A	116890.0	116890.0	116890.8	0.8
Train A O-Rings	12A	3399.9	3399.9	3400.0	0.1
Train B Filters	A027	118.5	238.2	239.5	1.3
	A028	119.7			
Train B Probe	12B	117942.0	117942.0	117942.2	0.2
Train B O-Rings	12B	3392.0	3392.0	3393.4	1.4
Background Filter			0.0	0.0	

Placed in Dessicator on:

Train A Filters - First Hour	121.5	6/19 14:14	121.3	6/25 15:12		
Train A Filters - Remainder	239.0	6/19 14:14	239.0	6/25 15:13		
Train A Probe	116890.7	6/19 14:21	116890.8	6/25 15:05		
Train A O-Rings	3400.3	6/19 14:12	3400.0	6/25 15:09		
Train B Filters	239.4	6/19 14:17	239.5	6/25 15:13		
Train B Probe	117942.1	6/19 14:21	117942.2	6/25 15:06		
Train B O-Rings	3393.3	6/19 14:12	3393.4	6/25 15:09		
Background Filter						

1st hour Sub-Total, mg:	1.8
Remainder Sub-Total, mg:	1.1
Train 1 Aggregate, mg:	2.9
Train 2 Aggregate, mg:	2.9
Ambient Aggregate, mg:	0.0

Form P407 ASTM E2780 Run Notes

Client: MF Fire Job Number: 20-606 Tracking #: 74
 Model: Nova 2 Run Number: 4 Test Date: 6/17/20

Test Control Settings

Primary Air Setting(s): N/A - Fixed
 Targeted Burn Category: N/A - Single BR

Preburn Notes

Time	Notes
	-None-

Test Notes

Test Burn Start Time: 13:42 Test Fuel Loaded by: 35 seconds
 Door Closed: 3:30 seconds Air Control Set at: N/A seconds
 Other Loading Notes: Fan on high

Time	Notes
60:00	Changed filter A

Test Burn End Time: 15:49


Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO₂ (%): 16.90 CO (%): 4.18
 Mid Gas CO₂ (%): 10.00 CO (%): 2.51

Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	9:18	9:23	9:20	16:07	16:12	16:10
CO ₂	0.02	9.94	16.80	-0.01	9.87	16.86
CO	0.007	2.489	4.144	-0.001	2.418	4.177

Flue Gas Probe Leak Check: Initial: No Leakage Final: No Leakage

Technician Signature: 

Date: 7/1/2020

Form P407 ASTM E2780 Run Notes

Client: MF Fire Job Number: 20-606 Tracking #: 74
Model: Nova 2 Run Number: 4 Test Date: 6/17/20




Test Fuel Front View



Test Fuel Iso View



Test Fuel Loaded in Stove

Technician Signature: 

Date: 7/1/2020

**WOOD STOVE TEST DATA PACKET
ASTM E2780/E2515**



Run 5 Data Summary

Client:	MF Fire
Model:	Nova 2
Job #:	20-606
Tracking #:	74
Test Date:	6/18/2020



Technician Signature

7/1/2020

Date

TEST RESULTS - ASTM E2780 / ASTM E2515

Client: MF Fire

Model: Nova 2

Run #: 5

Job #: 20-606

Tracking #: 74

Technician: A Kravitz

Date: 6/18/2020

Burn Rate (kg/hr):	2.29
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	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft ³)	0.000	19.673	19.524	7.950
Average Gas Velocity in Dilution Tunnel (ft/sec)	15.6			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	10026.1			
Average Gas Meter Temperature (°F)	78.5	98.9	100.8	94.3
Total Sample Volume (dscf)	0.000	18.735	18.603	7.632
Average Tunnel Temperature (°F)	112.6			
Total Time of Test (min)	147			
Total Particulate Catch (mg)	0.0	3.9	3.4	1.4
Particulate Concentration, dry-standard (g/dscf)	0.0000000	0.0002082	0.0001828	0.0001834
Total PM Emissions (g)	0.00	5.11	4.49	1.84
Particulate Emission Rate (g/hr)	0.00	2.09	1.83	1.84
Emissions Factor (g/kg)	-	0.91	0.80	-
Difference from Average Total Particulate Emissions (g)	-	0.31	0.31	-
Difference from Average Emissions Factor (g/kg)	-	0.06	0.06	-

Final Average Results	
Total Particulate Emissions (g)	4.80
Particulate Emission Rate (g/hr)	1.96
Emissions Factor (g/kg)	0.86
HHV Efficiency (%)	75.5%
LHV Efficiency (%)	81.6%
CO Emissions (g/min)	0.29

Quality Checks	Requirement	Observed	Result
Dual Train Precision	Each train within 7.5% of average emissions (in grams), or emission factors within 0.5 g/kg	See Above	OK
Filter Temps	<90 °F	81.0	OK
Face Velocity	< 30 ft/min	7.5	OK
Leakage Rate	Less than 4% of average sample rate	0.001 cfm	OK
Ambient Temp	55-90 °F	Min: 77 / Max: 80	OK
Negative Probe Weight Evaluation	<5% of Total Catch	Probe Catch Not Negative	OK
Pro-Rate Variation	90% of readings between 90-110%; none greater than 120% or less than 80%	See Data Tabs	OK
Stove Surface ΔT	<126°F	13.8	OK

Summary Table

Date	6/18/2020
Run Number	5
PM Emission Rate (g/hr)	1.96
Burn Rate (kg/hr)	2.29
Heat Output (BTU/hr)	31,205
HHV Efficiency (%)	75.5%
CO Emissions (g/MJ output)	0.53
CO Emissions (g/kg dry fuel)	7.88
CO Emissions (g/min)	0.29
First Hour Emission Rate (g/hr)	1.84

Conditions Summary

Run	Ambient (°F)		Relative Humidity (%)		Average Barometric Pressure (In. Hg.)
	Pre	Post	Pre	Post	
5	77	80	62.2	36.5	30.10

Preburn Fuel Weight (lbs)	Test Fuel Weight (lbs)	Test Fuel Moisture (%DB)	Test Run Time (Min)
14.2	14.98	22.1	147

B415.1 Efficiency Results

Manufacturer: MF Fire
Model: Nova 2
Date: 06/18/20
Run: 5
Control #: 20-606
Test Duration: 147
Output Category: 4

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	75.5%	81.6%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	75.9%	82.0%

Output Rate (kJ/h)	32,895	31,205	(Btu/h)
Burn Rate (kg/h)	2.20	4.85	(lb/h)
Input (kJ/h)	43,562	41,324	(Btu/h)

Test Load Weight (dry kg)	5.39	11.87	dry lb
MC wet (%)	18.11		
MC dry (%)	22.11		
Particulate (g)	4.80		
CO (g)	42		
Test Duration (h)	2.45		

Emissions	Particulate	CO
g/MJ Output	0.06	0.53
g/kg Dry Fuel	0.89	7.88
g/h	1.96	17.33
g/min	0.03	0.29
lb/MM Btu Output	0.14	1.22

Air/Fuel Ratio (A/F)	12.32
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VERSION:

2.2

12/14/2009

WOODSTOVE FUEL DATA - ASTM E2780

Client: MF Fire
 Model: Nova 2
 Run #: 5

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/18/2020

Preburn Fuel Information						
Size	Length (in)	Moisture Content (% DB)		Size	Length (in)	Moisture Content (% DB)
2x4	16.00	26.0		2x4	10.00	21.0
2x4	16.00	24.0		2x4	10.00	24.0
2x4	16.00	19.0		2x4	10.00	18.0
2x4	16.00	19.0				
2x4	10.00	18.0				
2x4	10.00	19.0				
2x4	10.00	20.0				
2x4	10.00	19.0				
Total Fuel Weight (lbs):		14.2		Average Moisture (%DB):		20.6

Firebox Volume (ft³): 2.4
 Total 2x4 Crib Weight, with spacers (lbs): 6.71
 Total 4x4 Crib Weight, with spacers (lbs): 7.98
 Total Wet Fuel Weight, with spacers (lbs): 14.98

Coal Bed Range (20-25%):
 Min (lbs): 3.00
 Max (lbs): 3.75

Test Fuel Information						
Size	Length (in)	Weight (lbs)	Moisture Content (%DB)			Dry Weight (lbs)
4x4	16.00	3.52	21.6	20.4	23.1	2.89
4x4	16.00	3.73	19.1	18.8	19.7	3.13
2x4	16.00	1.58	23.6	23.9	20.6	1.29
2x4	16.00	2.07	25.4	21.7	24.8	1.67
2x4	16.00	1.87	25.5	21.6	21.9	1.52
Total Dry Weight, no spacers (lbs):						10.50
Total Dry Weight, with spacers (lbs):						12.36

Spacer Moisture Readings (%DB)						
15.0						
14.0						
24.0						
23.0						

Quality Checks	Requirement	Observed	Result
Fuel Density	25 - 36 (lbs/ft ³ , DB)	28.2	OK
Loading Density	6.3 - 7.7 (lbs/ft ³ , WB)	6.35	OK
2x4 Fuel Mix	35 - 65 % of total weight	45%	OK

DILUTION TUNNEL & MISC. DATA - ASTM E2780 / E2515

Client: MF Fire
 Model: Nova 2
 Run #: 5
 Test Start Time:

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/18/2020

Total Sampling Time (min): 147
 Recording Interval (min): 1

Meter Box γ Factor: 0.998 (A)
 Meter Box γ Factor: 1.002 (B)
 Meter Box γ Factor: 1.000 (Ambient)

Induced Draft Check (in. H₂O): 0
 Smoke Capture Check (%): 100%
 Date Flue Pipe Last Cleaned: 6/4/2020

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	30.10	30.10	30.10
Relative Humidity (%)	62.2	36.5	
Room Air Velocity (ft/min)	0	0	
Scale Audit (lbs)	10.0	10.0	
Ambient Sample Volume:			ft ³

Sample Train Post-Test Leak Checks

(A)	0.001	cfm @	-7	in. Hg
(B)	0.000	cfm @	-10	in. Hg
(Ambient)		cfm @		in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H ₂ O)	Temp (°F)
1	0.034	105
2	0.066	105
3	0.062	105
4	0.036	105
5	0.040	105
6	0.066	105
7	0.068	105
8	0.030	105
Center	0.082	105

Dilution Tunnel H₂O: 2.00 percent
 Tunnel Diameter: 6 inches
 Pitot Tube Cp: 0.99 [unitless]
 Dilution Tunnel MW(dry): 29.00 lb/lb-mole
 Dilution Tunnel MW(wet): 28.78 lb/lb-mole
 Tunnel Area: 0.1963 ft²

V_{strav} : 15.63 ft/sec
 V_{scent} : 19.58 ft/sec
 F_p : 0.798 [ratio]
 Initial Tunnel Flow: 164.2 scf/min

Static Pressure: -0.180 in. H₂O

TEST FUEL PROPERTIES

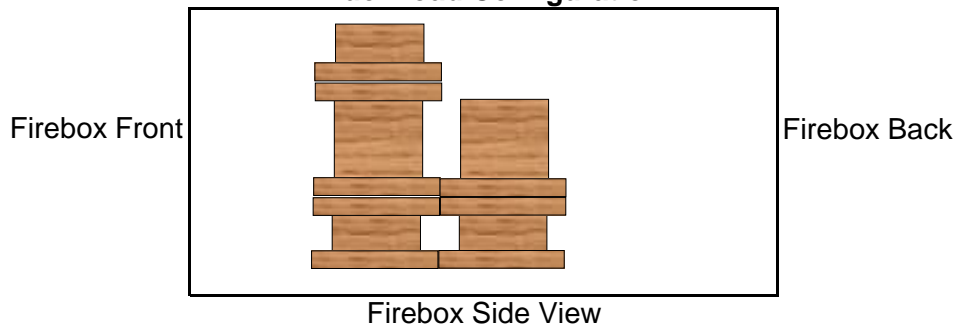
Default Fuel Values

Fuel Type:	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

Actual Fuel Used Properties

Fuel Type:	D. Fir
HHV (kJ/kg)	19,810
%C	48.73
%H	6.87
%O	43.9
%Ash	0.5
MC (%DB)	22.1

Fuel Load Configuration



BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF FireJob #: 20-606Model: Nova 2Tracking #: 74Run #: 5Technician: A KravitzDate: 6/18/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.091	0.02	90	-0.13		14.5		104	335	75	77
1	0.127	0.127	0.073	1.77	89	-0.51	102	14.4	-0.1	116	344	76	77
2	0.257	0.130	0.075	1.75	89	-0.86	103	14.3	-0.1	121	343	77	77
3	0.387	0.130	0.082	1.79	89	-0.84	100	14.0	-0.3	129	373	77	78
4	0.521	0.134	0.078	1.78	90	-0.67	106	13.8	-0.2	135	446	78	78
5	0.650	0.129	0.089	1.75	90	-0.8	94	13.6	-0.2	123	423	78	77
6	0.781	0.131	0.073	1.77	90	-0.63	106	13.5	-0.1	126	409	78	77
7	0.914	0.133	0.081	1.78	90	-0.94	101	13.2	-0.3	118	394	78	77
8	1.044	0.130	0.074	1.77	90	-0.83	103	13.0	-0.2	115	397	78	77
9	1.174	0.130	0.088	1.75	91	-0.85	94	12.9	-0.1	114	404	78	77
10	1.309	0.135	0.079	1.79	91	-0.66	103	12.8	-0.1	113	407	78	77
11	1.437	0.128	0.082	1.74	91	-0.83	96	12.7	-0.1	112	410	78	77
12	1.570	0.133	0.073	1.75	91	-1.06	106	12.5	-0.2	113	415	79	77
13	1.704	0.134	0.082	1.75	91	-0.74	101	12.3	-0.2	112	419	79	77
14	1.832	0.128	0.073	1.76	91	-0.63	102	12.1	-0.2	113	423	79	77
15	1.967	0.135	0.083	1.77	92	-0.76	101	12.0	-0.1	113	423	79	77
16	2.098	0.131	0.074	1.78	92	-0.75	104	11.8	-0.2	113	424	79	77
17	2.228	0.130	0.081	1.77	92	-0.82	98	11.7	-0.1	114	428	79	77
18	2.364	0.136	0.076	1.75	92	-0.69	106	11.5	-0.2	114	437	79	77
19	2.494	0.130	0.074	1.76	93	-0.62	103	11.2	-0.3	115	444	79	77
20	2.625	0.131	0.080	1.78	93	-0.85	100	11.1	-0.1	115	445	79	77
21	2.759	0.134	0.085	1.80	93	-0.76	99	10.9	-0.2	115	444	79	77
22	2.891	0.132	0.084	1.77	93	-0.67	98	10.8	-0.1	116	446	79	77
23	3.022	0.131	0.086	1.77	93	-0.93	96	10.5	-0.3	116	442	79	77
24	3.156	0.134	0.078	1.76	93	-0.62	103	10.2	-0.3	116	449	79	77
25	3.288	0.132	0.086	1.81	94	-0.71	97	10.1	-0.1	116	453	79	77
26	3.420	0.132	0.094	1.81	94	-0.76	92	10.0	-0.1	116	448	79	77
27	3.555	0.135	0.070	1.80	94	-0.56	110	9.8	-0.2	115	447	79	77
28	3.684	0.129	0.078	1.77	94	-0.98	99	9.6	-0.2	116	453	80	77
29	3.819	0.135	0.081	1.81	94	-1	102	9.4	-0.2	116	457	80	78
30	3.953	0.134	0.077	1.81	95	-0.92	104	9.2	-0.2	116	454	80	78
31	4.082	0.129	0.074	1.78	95	-0.76	102	9.1	-0.1	117	453	80	78

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 5

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/18/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
32	4.219	0.137	0.088	1.79	95	-0.91	99	8.9	-0.2	116	459	80	77
33	4.350	0.131	0.087	1.78	95	-0.73	95	8.7	-0.2	117	461	80	78
34	4.483	0.133	0.074	1.80	95	-0.96	105	8.5	-0.2	117	461	80	78
35	4.618	0.135	0.084	1.78	95	-1	100	8.3	-0.2	117	458	80	78
36	4.750	0.132	0.092	1.80	96	-0.91	93	8.0	-0.3	117	462	80	78
37	4.882	0.132	0.081	1.79	96	-0.95	99	7.9	-0.1	117	461	80	78
38	5.018	0.136	0.073	1.80	96	-0.75	108	7.6	-0.3	118	461	80	77
39	5.149	0.131	0.080	1.80	96	-0.67	99	7.5	-0.1	118	464	80	78
40	5.283	0.134	0.085	1.82	96	-0.64	99	7.3	-0.2	118	467	80	78
41	5.418	0.135	0.086	1.81	96	-0.69	99	7.1	-0.2	118	469	80	78
42	5.548	0.130	0.084	1.80	97	-0.91	96	6.9	-0.2	118	472	80	78
43	5.684	0.136	0.083	1.79	97	-0.82	101	6.8	-0.1	118	471	80	79
44	5.816	0.132	0.085	1.78	97	-0.83	97	6.6	-0.2	119	470	80	79
45	5.949	0.133	0.082	1.81	97	-0.98	100	6.3	-0.3	120	467	80	79
46	6.084	0.135	0.070	1.78	97	-0.84	109	6.2	-0.1	118	467	80	78
47	6.216	0.132	0.072	1.78	97	-0.75	105	6.1	-0.1	118	465	80	79
48	6.348	0.132	0.076	1.79	97	-0.74	102	6.0	-0.1	118	464	80	79
49	6.484	0.136	0.083	1.81	98	-1.03	101	5.8	-0.2	118	463	80	79
50	6.615	0.131	0.076	1.79	98	-1.01	101	5.6	-0.2	117	461	80	79
51	6.748	0.133	0.093	1.78	98	-0.87	93	5.5	-0.1	118	459	80	79
52	6.884	0.136	0.080	1.80	98	-0.94	103	5.4	-0.1	118	456	80	79
53	7.013	0.129	0.075	1.77	98	-0.83	101	5.3	-0.1	118	452	80	78
54	7.150	0.137	0.074	1.82	98	-0.82	107	5.2	-0.1	117	449	80	79
55	7.282	0.132	0.078	1.77	98	-1.04	101	5.1	-0.1	118	445	80	79
56	7.414	0.132	0.078	1.75	99	-0.68	101	5.0	-0.1	117	440	80	79
57	7.549	0.135	0.080	1.76	99	-0.71	102	4.9	-0.1	116	436	80	79
58	7.682	0.133	0.079	1.78	99	-0.77	101	4.8	-0.1	116	434	80	79
59	7.814	0.132	0.074	1.79	99	-0.89	103	4.7	-0.1	115	432	80	79
60	7.950	0.136	0.075	1.78	99	-0.79	106	4.6	-0.1	115	428	80	80
61	8.081	0.131	0.086	1.77	99	-0.66	95	4.5	-0.1	115	426	81	79
62	8.215	0.134	0.088	1.79	99	-1	96	4.4	-0.1	115	423	81	79
63	8.352	0.137	0.074	1.80	99	-1.02	107	4.3	-0.1	114	422	81	79

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 5

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/18/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
64	8.484	0.132	0.078	1.82	99	-1	101	4.2	-0.1	115	420	81	79
65	8.621	0.137	0.082	1.80	100	-0.85	101	4.1	-0.1	114	419	81	79
66	8.755	0.134	0.077	1.81	100	-0.98	102	4.0	-0.1	114	417	81	79
67	8.888	0.133	0.090	1.81	100	-0.77	94	3.9	-0.1	114	416	81	79
68	9.026	0.138	0.085	1.81	100	-0.69	100	3.9	0	114	414	81	79
69	9.158	0.132	0.080	1.82	100	-0.88	99	3.7	-0.2	114	412	81	79
70	9.295	0.137	0.078	1.82	100	-0.96	104	3.7	0	113	410	81	79
71	9.429	0.134	0.075	1.81	100	-0.68	104	3.5	-0.2	114	409	81	79
72	9.563	0.134	0.076	1.80	100	-0.71	103	3.5	0	113	406	81	79
73	9.701	0.138	0.078	1.79	100	-0.69	105	3.4	-0.1	113	406	81	78
74	9.835	0.134	0.086	1.80	101	-0.94	97	3.3	-0.1	113	404	81	79
75	9.969	0.134	0.090	1.82	101	-0.83	94	3.2	-0.1	113	403	81	79
76	10.107	0.138	0.073	1.84	101	-0.69	108	3.2	0	113	401	81	79
77	10.238	0.131	0.085	1.82	101	-0.74	95	3.1	-0.1	113	399	81	79
78	10.378	0.140	0.073	1.83	101	-0.57	110	3.1	0	113	399	81	79
79	10.511	0.133	0.072	1.79	101	-0.61	105	3.0	-0.1	114	398	81	79
80	10.646	0.135	0.074	1.81	101	-0.8	105	2.9	-0.1	113	397	81	78
81	10.784	0.138	0.086	1.83	101	-0.85	99	2.8	-0.1	112	395	80	79
82	10.916	0.132	0.081	1.84	101	-0.95	98	2.7	-0.1	112	394	80	79
83	11.054	0.138	0.070	1.79	101	-0.91	110	2.6	-0.1	110	392	80	80
84	11.189	0.135	0.089	1.76	101	-0.81	95	2.6	0	110	391	80	79
85	11.324	0.135	0.078	1.78	101	-0.87	102	2.5	-0.1	112	390	80	79
86	11.461	0.137	0.088	1.81	101	-0.81	97	2.4	-0.1	110	387	80	79
87	11.596	0.135	0.079	1.83	102	-0.86	101	2.3	-0.1	109	387	80	79
88	11.731	0.135	0.082	1.82	102	-0.87	99	2.3	0	109	386	80	80
89	11.869	0.138	0.079	1.84	102	-1	103	2.2	-0.1	109	385	80	79
90	12.002	0.133	0.079	1.85	102	-0.63	100	2.1	-0.1	109	384	80	79
91	12.140	0.138	0.079	1.82	102	-0.75	103	2.1	0	110	384	80	79
92	12.275	0.135	0.092	1.86	102	-0.84	94	2.0	-0.1	110	384	80	79
93	12.410	0.135	0.077	1.85	102	-0.82	102	1.9	-0.1	110	383	79	79
94	12.548	0.138	0.078	1.84	102	-0.86	104	1.9	0	111	381	79	79
95	12.681	0.133	0.086	1.82	102	-0.98	96	1.8	-0.1	111	380	79	78

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 5

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/18/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
96	12.820	0.139	0.086	1.83	102	-0.92	100	1.8	0	111	380	79	78
97	12.954	0.134	0.083	1.83	102	-0.7	98	1.7	-0.1	109	380	79	79
98	13.089	0.135	0.089	1.83	102	-0.67	95	1.7	0	109	381	79	78
99	13.228	0.139	0.077	1.87	102	-1.04	105	1.6	-0.1	109	380	79	78
100	13.360	0.132	0.087	1.87	102	-0.8	94	1.5	-0.1	109	380	79	79
101	13.499	0.139	0.084	1.87	102	-0.74	101	1.5	0	110	381	79	79
102	13.634	0.135	0.084	1.84	102	-0.74	98	1.5	0	110	379	79	79
103	13.769	0.135	0.072	1.86	102	-0.69	106	1.4	-0.1	111	377	80	79
104	13.906	0.137	0.082	1.85	102	-0.84	101	1.4	0	110	375	80	79
105	14.041	0.135	0.073	1.83	102	-0.85	105	1.3	-0.1	110	373	80	80
106	14.177	0.136	0.082	1.84	102	-0.53	100	1.3	0	110	370	80	79
107	14.314	0.137	0.085	1.82	102	-0.63	99	1.3	0	109	368	80	79
108	14.448	0.134	0.082	1.80	102	-1.12	98	1.2	-0.1	109	366	80	79
109	14.586	0.138	0.092	1.79	102	-0.91	96	1.2	0	109	364	80	79
110	14.720	0.134	0.075	1.83	102	-0.89	103	1.1	-0.1	109	363	80	79
111	14.854	0.134	0.083	1.78	102	-0.97	98	1.1	0	109	361	80	79
112	14.991	0.137	0.087	1.80	102	-0.76	98	1.1	0	109	359	80	79
113	15.121	0.130	0.076	1.77	102	-0.57	99	1.0	-0.1	108	357	80	79
114	15.257	0.136	0.079	1.76	103	-0.7	102	1.0	0	109	357	80	80
115	15.390	0.133	0.084	1.76	103	-0.85	96	1.0	0	109	356	80	79
116	15.522	0.132	0.086	1.76	103	-0.61	95	1.0	0	109	356	80	79
117	15.658	0.136	0.076	1.78	103	-0.65	104	0.9	-0.1	108	354	80	79
118	15.791	0.133	0.082	1.78	103	-0.67	97	0.9	0	108	353	80	79
119	15.924	0.133	0.064	1.79	103	-0.7	110	0.9	0	108	352	80	79
120	16.060	0.136	0.079	1.76	103	-0.7	102	0.8	-0.1	108	352	80	79
121	16.192	0.132	0.072	1.79	103	-0.69	103	0.8	0	108	351	81	79
122	16.325	0.133	0.077	1.75	103	-0.71	101	0.8	0	107	350	81	79
123	16.461	0.136	0.080	1.80	103	-0.69	101	0.7	-0.1	107	349	81	79
124	16.591	0.130	0.083	1.78	103	-0.45	95	0.7	0	107	348	81	79
125	16.728	0.137	0.095	1.76	103	-0.66	93	0.7	0	107	347	81	78
126	16.860	0.132	0.081	1.77	103	-0.84	97	0.7	0	107	345	81	79
127	16.993	0.133	0.091	1.76	103	-0.7	92	0.6	-0.1	107	344	81	79

BOX A TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 5

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/18/2020

Elapsed Time (min)	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
	Gas Meter (ft ³)	Sample Rate (cfm)	Dilution Tunnel dP (in H ₂ O)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
128	17.129	0.136	0.089	1.76	103	-0.69	96	0.6	0	106	343	81	79
129	17.262	0.133	0.097	1.78	103	-0.62	90	0.5	-0.1	107	342	81	79
130	17.395	0.133	0.086	1.77	103	-0.65	95	0.5	0	106	341	81	79
131	17.531	0.136	0.095	1.80	103	-0.91	92	0.5	0	106	342	81	79
132	17.661	0.130	0.074	1.78	103	-0.67	100	0.4	-0.1	106	341	81	79
133	17.798	0.137	0.075	1.78	103	-0.69	105	0.4	0	106	340	81	79
134	17.931	0.133	0.084	1.76	104	-0.8	96	0.4	0	106	339	81	79
135	18.064	0.133	0.081	1.77	103	-0.85	98	0.4	0	106	339	81	79
136	18.200	0.136	0.085	1.78	103	-0.61	98	0.4	0	107	339	81	79
137	18.333	0.133	0.089	1.75	104	-0.9	93	0.3	-0.1	107	339	81	79
138	18.466	0.133	0.076	1.80	104	-0.61	101	0.3	0	107	340	81	80
139	18.603	0.137	0.084	1.81	104	-1.06	99	0.3	0	106	340	81	79
140	18.734	0.131	0.085	1.78	104	-0.93	94	0.2	-0.1	106	339	81	79
141	18.868	0.134	0.073	1.75	104	-0.57	104	0.2	0	107	339	81	79
142	19.003	0.135	0.086	1.79	104	-0.89	96	0.2	0	107	339	81	79
143	19.134	0.131	0.085	1.77	104	-0.49	94	0.1	-0.1	107	339	81	80
144	19.272	0.138	0.069	1.80	104	-0.85	110	0.1	0	107	339	81	79
145	19.403	0.131	0.078	1.79	104	-0.87	98	0.1	0	107	337	81	80
146	19.538	0.135	0.082	1.82	104	-0.93	99	0.1	0	106	337	81	80
147	19.673	0.135	0.079	1.81	104	-0.91	100	0.0	-0.1	106	337	81	80
Avg/Tot	19.673	0.134	0.081	1.78	99	-0.79	100			113	400	80	78.5

WOODSTOVE PREBURN DATA - ASTM E2780

Client: MF Fire
 Model: Nova 2
 Run #: 5

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/18/2020

Recording Interval (min): 1
 Run Time (min): 109

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	Temperatures (°F)							Flue	Ambient
			FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average			
0	16.4	-0.079	302	271	245	591	187	319.2	447	74	
1	16.4	-0.090	302	272	245	591	187	319.4	448	74	
2	16.3	-0.083	302	271	244	577	188	316.4	464	74	
3	16.1	-0.084	301	271	243	571	190	315.2	471	74	
4	15.8	-0.093	300	266	242	578	191	315.4	492	74	
5	15.5	-0.091	299	268	242	604	192	321.0	524	74	
6	15.2	-0.100	298	267	241	632	193	326.2	544	74	
7	14.9	-0.093	298	267	240	659	194	331.6	557	74	
8	14.6	-0.091	298	266	240	683	194	336.2	568	74	
9	14.3	-0.092	299	267	240	701	195	340.4	576	75	
10	14.0	-0.101	300	262	241	721	196	344.0	587	75	
11	13.7	-0.094	302	262	241	739	197	348.2	593	75	
12	13.4	-0.091	304	265	242	753	198	352.4	600	75	
13	13.0	-0.093	306	263	243	763	199	354.8	545	75	
14	13.0	-0.089	308	262	244	764	200	355.6	509	75	
15	12.7	-0.086	311	263	246	757	202	355.8	487	75	
16	12.7	-0.088	313	258	247	746	203	353.4	475	75	
17	12.5	-0.089	315	264	248	729	204	352.0	468	75	
18	12.4	-0.079	317	261	249	716	205	349.6	463	75	
19	12.1	-0.084	319	264	250	699	207	347.8	461	74	
20	12.0	-0.083	320	265	250	689	208	346.4	458	75	
21	11.9	-0.089	321	265	251	681	210	345.6	457	75	
22	11.8	-0.082	322	267	251	673	211	344.8	452	75	
23	11.5	-0.079	322	265	251	670	212	344.0	448	75	
24	11.5	-0.083	322	268	251	666	214	344.2	445	75	
25	11.4	-0.080	323	266	251	666	215	344.2	442	75	
26	11.3	-0.075	323	266	251	666	216	344.4	441	75	
27	11.1	-0.075	322	265	251	668	218	344.8	438	75	
28	11.0	-0.078	323	269	251	669	219	346.2	438	75	
29	10.8	-0.085	322	266	251	674	220	346.6	439	75	
30	10.6	-0.081	322	260	250	680	221	346.6	441	75	
31	10.5	-0.086	321	261	249	686	221	347.6	442	75	
32	10.3	-0.077	321	255	249	693	222	348.0	443	75	
33	10.2	-0.079	320	257	249	701	223	350.0	446	75	
34	10.0	-0.081	320	257	250	708	223	351.6	448	76	
35	9.8	-0.085	320	264	250	716	224	354.8	450	75	
36	9.5	-0.091	320	269	251	724	225	357.8	452	75	
37	9.4	-0.081	320	272	252	732	226	360.4	455	76	
38	9.3	-0.088	320	273	252	740	227	362.4	457	75	
39	9.0	-0.081	321	272	253	749	229	364.8	458	75	
40	8.9	-0.079	321	272	254	754	230	366.2	460	75	
41	8.8	-0.085	322	274	255	762	230	368.6	460	76	
42	8.6	-0.094	323	274	256	767	231	370.2	460	76	
43	8.2	-0.080	324	275	257	770	232	371.6	461	76	
44	8.3	-0.083	325	276	258	772	233	372.8	462	76	

WOODSTOVE PREBURN DATA - ASTM E2780

Client: MF Fire
 Model: Nova 2
 Run #: 5

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/18/2020

Recording Interval (min): 1
 Run Time (min): 109

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	Temperatures (°F)							Flue	Ambient
			FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average			
45	8.1	-0.077	325	277	259	773	233	373.4	463	76	
46	7.9	-0.079	327	278	260	776	234	375.0	463	76	
47	7.8	-0.082	328	279	261	778	235	376.2	462	76	
48	7.6	-0.079	330	282	262	779	236	377.8	462	76	
49	7.5	-0.081	332	285	264	780	236	379.4	462	76	
50	7.4	-0.080	333	287	265	782	237	380.8	462	76	
51	7.2	-0.073	334	287	267	781	237	381.2	461	76	
52	7.1	-0.083	335	285	268	780	238	381.2	460	76	
53	7.0	-0.081	336	287	270	779	239	382.2	459	76	
54	6.9	-0.077	337	288	271	777	240	382.6	459	76	
55	6.7	-0.081	339	291	273	773	241	383.4	457	76	
56	6.6	-0.077	339	291	275	769	241	383.0	454	76	
57	6.5	-0.076	340	289	276	765	242	382.4	452	77	
58	6.4	-0.083	341	292	278	760	243	382.8	450	77	
59	6.2	-0.080	341	292	279	754	243	381.8	449	77	
60	6.1	-0.083	343	290	281	751	244	381.8	447	77	
61	6.0	-0.077	343	294	283	749	245	382.8	446	77	
62	5.9	-0.081	344	294	284	745	246	382.6	444	77	
63	5.8	-0.085	344	295	286	740	247	382.4	440	77	
64	5.7	-0.078	345	294	288	735	248	382.0	436	77	
65	5.7	-0.086	345	294	290	729	249	381.4	432	77	
66	5.6	-0.075	346	294	291	721	251	380.6	427	77	
67	5.4	-0.078	346	295	293	713	252	379.8	424	76	
68	5.4	-0.077	346	297	295	707	253	379.6	421	77	
69	5.3	-0.075	347	298	297	700	254	379.2	418	77	
70	5.3	-0.068	347	298	299	693	256	378.6	415	77	
71	5.2	-0.073	348	298	301	686	257	378.0	412	78	
72	5.1	-0.070	348	298	303	679	259	377.4	410	77	
73	5.1	-0.071	349	301	304	671	260	377.0	407	77	
74	4.9	-0.075	350	301	305	663	261	376.0	403	77	
75	4.9	-0.072	350	301	307	655	263	375.2	400	77	
76	4.9	-0.075	350	300	309	646	264	373.8	398	77	
77	4.9	-0.075	350	298	310	637	265	372.0	394	77	
78	4.7	-0.075	352	303	312	629	267	372.6	392	77	
79	4.7	-0.069	352	305	312	621	268	371.6	390	77	
80	4.7	-0.074	352	306	314	614	270	371.2	388	77	
81	4.6	-0.070	352	307	315	606	271	370.2	385	77	
82	4.6	-0.071	352	303	315	600	272	368.4	384	77	
83	4.6	-0.075	351	304	315	594	274	367.6	383	77	
84	4.5	-0.072	352	306	316	589	276	367.8	381	77	
85	4.5	-0.066	351	305	316	584	277	366.6	380	77	
86	4.5	-0.068	351	303	317	579	279	365.8	379	77	
87	4.3	-0.064	351	304	317	575	280	365.4	377	77	
88	4.4	-0.072	350	303	318	570	281	364.4	375	77	
89	4.3	-0.059	350	303	317	565	283	363.6	374	77	

WOODSTOVE PREBURN DATA - ASTM E2780

Client: MF Fire
 Model: Nova 2
 Run #: 5

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/18/2020

Recording Interval (min): 1
 Run Time (min): 109

Elapsed Time (min)	Scale Reading (lbs)	Flue Draft (in H ₂ O)	Temperatures (°F)							Flue	Ambient
			FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average			
90	4.3	-0.067	349	303	317	560	284	362.6	372	77	
91	4.3	-0.070	349	302	318	555	286	362.0	371	77	
92	4.2	-0.066	348	303	318	550	288	361.4	370	77	
93	4.2	-0.066	348	302	318	546	289	360.6	367	77	
94	4.1	-0.068	347	304	318	542	290	360.2	365	77	
95	4.1	-0.062	347	299	318	537	292	358.6	363	77	
96	3.7	-0.074	347	304	318	532	293	358.8	382	78	
97	3.9	-0.063	347	305	316	526	295	357.8	365	78	
98	3.9	-0.062	346	300	317	523	296	356.4	355	77	
99	3.8	-0.067	345	302	318	518	297	356.0	350	77	
100	3.8	-0.061	345	302	318	514	297	355.2	347	77	
101	3.8	-0.064	344	302	318	510	299	354.6	345	77	
102	3.7	-0.058	344	304	318	507	301	354.8	344	77	
103	3.7	-0.064	344	302	318	502	302	353.6	343	77	
104	3.7	-0.063	343	306	319	500	303	354.2	342	78	
105	3.7	-0.060	342	305	319	495	304	353.0	341	77	
106	3.6	-0.060	342	301	318	493	305	351.8	340	77	
107	3.6	-0.054	341	301	317	490	305	350.8	339	76	
108	3.6	-0.060	340	302	317	488	305	350.4	338	77	
109	3.6	-0.066	339	301	317	484	307	349.6	337	77	

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 5

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/18/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
0	0.000		0.00	90	-1		78	0.000	5.93	0.02
1	0.122	0.122	1.80	90	0	99	78	-0.060	4.89	0.05
2	0.253	0.131	1.79	90	-2.61	105	78	-0.060	1.71	0.32
3	0.386	0.133	1.78	90	0	103	78	-0.080	3.62	0.22
4	0.516	0.130	1.77	90	0	103	78	-0.080	6.83	0.19
5	0.647	0.131	1.79	91	-0.4	96	78	-0.070	12.29	0.74
6	0.780	0.133	1.79	91	0	108	78	-0.070	5.58	0.04
7	0.911	0.131	1.78	91	-3.22	101	78	-0.070	7.75	0.13
8	1.042	0.131	1.78	91	-2.55	105	78	-0.070	8.96	0.08
9	1.174	0.132	1.79	91	-3.26	97	78	-0.090	10.60	0.05
10	1.305	0.131	1.79	92	0	101	78	-0.070	10.70	0.01
11	1.435	0.130	1.80	92	-0.25	99	78	-0.080	8.65	0.00
12	1.570	0.135	1.78	92	0	109	78	-0.070	9.50	0.05
13	1.701	0.131	1.80	92	-0.08	99	78	-0.080	11.15	0.03
14	1.831	0.130	1.79	92	-2.84	105	78	-0.070	10.77	0.06
15	1.965	0.134	1.78	93	0	101	78	-0.070	10.66	0.00
16	2.095	0.130	1.78	93	-3.27	104	78	-0.080	10.49	0.02
17	2.226	0.131	1.78	93	-3.11	100	78	-0.080	11.05	0.04
18	2.361	0.135	1.78	93	0	106	78	-0.080	12.51	0.00
19	2.490	0.129	1.80	94	-3.32	103	78	-0.080	13.89	0.27
20	2.624	0.134	1.79	94	0	103	78	-0.090	13.45	0.06
21	2.756	0.132	1.79	94	0	98	78	-0.080	12.35	0.05
22	2.886	0.130	1.78	94	-2.34	97	78	-0.080	12.21	0.02
23	3.021	0.135	1.80	94	0	100	78	-0.080	12.66	0.00
24	3.152	0.131	1.80	95	-0.16	102	79	-0.080	12.86	0.01
25	3.283	0.131	1.80	95	-0.44	97	79	-0.090	13.75	0.12
26	3.417	0.134	1.79	95	-3.08	95	79	-0.080	13.70	0.00
27	3.549	0.132	1.79	95	-2.3	108	79	-0.090	12.65	0.00
28	3.681	0.132	1.79	95	-3.21	102	79	-0.080	13.74	0.05
29	3.814	0.133	1.78	96	-3.28	101	79	-0.080	14.30	0.13
30	3.946	0.132	1.79	96	-0.97	103	79	-0.080	13.97	0.01
31	4.078	0.132	1.81	96	-1.85	105	79	-0.080	13.31	0.00

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 5

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/18/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
32	4.213	0.135	1.79	96	-3.22	98	79	-0.080	13.93	0.15
33	4.343	0.130	1.79	96	0	95	79	-0.080	14.19	0.09
34	4.476	0.133	1.78	97	-3.38	106	79	-0.080	14.45	0.11
35	4.611	0.135	1.79	97	-0.59	101	79	-0.080	14.11	0.00
36	4.740	0.129	1.80	97	0	92	79	-0.080	14.71	0.08
37	4.875	0.135	1.80	97	-1.25	103	79	-0.080	15.02	0.07
38	5.007	0.132	1.80	97	-3.29	106	79	-0.090	15.29	0.04
39	5.138	0.131	1.80	97	-2.2	100	79	-0.090	15.72	0.12
40	5.273	0.135	1.78	98	-2.9	100	79	-0.080	15.79	0.26
41	5.405	0.132	1.79	98	-1.49	97	79	-0.080	15.81	0.32
42	5.537	0.132	1.80	98	-3.27	98	79	-0.080	16.05	0.31
43	5.670	0.133	1.77	98	0	100	79	-0.080	15.84	0.27
44	5.803	0.133	1.78	98	-3.28	99	79	-0.070	15.04	0.12
45	5.934	0.131	1.79	98	-2.59	99	79	-0.070	14.62	0.02
46	6.069	0.135	1.77	99	0	110	79	-0.080	14.30	0.04
47	6.200	0.131	1.78	99	0	105	79	-0.080	14.17	0.06
48	6.331	0.131	1.77	99	-2.83	102	79	-0.080	14.08	0.07
49	6.466	0.135	1.76	99	0	101	79	-0.080	13.65	0.04
50	6.596	0.130	1.77	99	-0.83	102	79	-0.090	13.25	0.00
51	6.730	0.134	1.78	99	-3.32	95	79	-0.070	13.03	0.00
52	6.863	0.133	1.78	100	-3.41	101	79	-0.090	12.50	0.01
53	6.994	0.131	1.78	100	0	103	79	-0.080	12.27	0.00
54	7.128	0.134	1.78	100	-0.19	106	79	-0.070	11.76	0.00
55	7.260	0.132	1.79	100	-3.28	102	79	-0.080	11.06	0.00
56	7.392	0.132	1.76	100	-3.39	102	79	-0.070	10.44	0.00
57	7.526	0.134	1.78	100	-0.26	102	79	-0.080	10.54	0.00
58	7.659	0.133	1.78	100	0	102	79	-0.070	10.49	0.00
59	7.790	0.131	1.76	101	-2.78	103	79	-0.070	10.36	0.00
60	7.925	0.135	1.77	101	-2.1	106	79	-0.080	10.40	0.00
61	8.056	0.131	1.78	101	-2.18	96	79	-0.080	10.04	0.00
62	8.188	0.132	1.77	101	-2.23	95	80	-0.080	10.07	0.00
63	8.324	0.136	1.79	101	-2.65	107	79	-0.080	9.92	0.03

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 5

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/18/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
64	8.454	0.130	1.78	101	-3.3	100	80	-0.080	10.02	0.00
65	8.588	0.134	1.79	101	-0.39	100	80	-0.070	9.96	0.00
66	8.722	0.134	1.78	102	-3.04	103	80	-0.080	10.02	0.00
67	8.853	0.131	1.79	102	0	93	80	-0.070	10.16	0.00
68	8.988	0.135	1.77	102	-2.28	99	80	-0.070	10.01	0.00
69	9.120	0.132	1.78	102	-0.04	100	80	-0.080	9.98	0.01
70	9.253	0.133	1.78	102	-3.21	102	80	-0.070	9.92	0.00
71	9.386	0.133	1.78	102	-1.04	104	80	-0.070	9.97	0.00
72	9.519	0.133	1.78	102	-2.83	103	80	-0.070	9.92	0.00
73	9.651	0.132	1.79	102	-0.08	101	80	-0.080	9.89	0.00
74	9.787	0.136	1.78	102	-2	99	80	-0.070	9.99	0.00
75	9.917	0.130	1.80	103	-3.14	92	80	-0.080	9.88	0.00
76	10.052	0.135	1.79	103	0	106	80	-0.080	9.71	0.00
77	10.185	0.133	1.79	103	-1.53	97	80	-0.080	9.86	0.00
78	10.317	0.132	1.78	103	-2.88	104	80	-0.080	9.77	0.02
79	10.452	0.135	1.79	103	-3.24	107	80	-0.080	9.71	0.01
80	10.584	0.132	1.78	103	-0.01	103	80	-0.080	9.77	0.00
81	10.717	0.133	1.79	103	-2.62	97	80	-0.080	9.80	0.00
82	10.851	0.134	1.78	104	-0.31	100	80	-0.090	9.68	0.00
83	10.984	0.133	1.78	104	-0.37	107	79	-0.070	9.57	0.00
84	11.116	0.132	1.77	104	-0.04	94	80	-0.090	9.62	0.00
85	11.252	0.136	1.79	104	-3.26	104	79	-0.070	9.67	0.00
86	11.383	0.131	1.78	104	-3.06	94	79	-0.070	9.49	0.00
87	11.517	0.134	1.79	104	-3.09	101	79	-0.070	9.61	0.00
88	11.651	0.134	1.79	104	0	99	79	-0.080	9.66	0.00
89	11.783	0.132	1.80	104	-2.32	100	79	-0.070	9.93	0.00
90	11.918	0.135	1.80	104	-0.07	102	79	-0.070	9.77	0.00
91	12.051	0.133	1.79	104	-3.08	100	79	-0.070	9.89	0.00
92	12.184	0.133	1.79	104	-3.11	93	79	-0.080	9.97	0.00
93	12.318	0.134	1.79	104	-3.17	102	79	-0.070	9.93	0.00
94	12.451	0.133	1.78	104	-0.49	101	79	-0.070	9.43	0.00
95	12.583	0.132	1.79	104	-1.45	96	79	-0.070	9.17	0.00

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 5

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/18/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
96	12.719	0.136	1.78	105	-2.05	98	79	-0.070	8.95	0.01
97	12.850	0.131	1.79	105	0	96	79	-0.070	8.65	0.00
98	12.985	0.135	1.79	105	-1.83	96	79	-0.060	8.85	0.00
99	13.118	0.133	1.79	105	-0.35	101	79	-0.070	8.71	0.00
100	13.250	0.132	1.78	105	0	95	79	-0.060	8.72	0.00
101	13.385	0.135	1.78	105	0	99	80	-0.070	8.89	0.03
102	13.518	0.133	1.79	105	-0.02	97	80	-0.070	8.71	0.00
103	13.651	0.133	1.77	105	-3.19	105	79	-0.070	8.57	0.02
104	13.785	0.134	1.78	105	-3.23	99	80	-0.070	8.46	0.00
105	13.918	0.133	1.77	105	-3.36	104	79	-0.070	8.06	0.00
106	14.050	0.132	1.79	105	-0.44	98	80	-0.070	7.92	0.00
107	14.186	0.136	1.77	105	-3.24	99	80	-0.080	7.61	0.00
108	14.317	0.131	1.78	105	-0.15	97	80	-0.060	7.82	0.00
109	14.452	0.135	1.79	105	-2.08	94	80	-0.060	7.76	0.00
110	14.585	0.133	1.77	105	-2.04	103	80	-0.080	7.61	0.00
111	14.717	0.132	1.78	105	-0.59	97	80	-0.070	7.68	0.01
112	14.852	0.135	1.79	105	-0.88	97	80	-0.060	7.65	0.02
113	14.986	0.134	1.78	105	-3.15	103	80	-0.070	7.68	0.01
114	15.118	0.132	1.79	105	-1.96	99	80	-0.070	7.62	0.00
115	15.253	0.135	1.77	105	-3.25	99	80	-0.060	7.60	0.00
116	15.386	0.133	1.79	105	-3.38	96	80	-0.060	7.50	0.04
117	15.518	0.132	1.78	105	0	101	80	-0.070	7.65	0.03
118	15.654	0.136	1.77	105	0	100	80	-0.050	7.73	0.00
119	15.785	0.131	1.79	105	-3.13	109	80	-0.070	7.56	0.00
120	15.920	0.135	1.79	105	0	102	80	-0.060	7.47	0.03
121	16.053	0.133	1.79	105	-1.07	105	80	-0.060	7.51	0.00
122	16.186	0.133	1.78	105	-1.77	101	80	-0.060	7.66	0.00
123	16.321	0.135	1.78	106	-3.34	101	80	-0.060	7.56	0.01
124	16.454	0.133	1.78	106	-0.46	97	80	-0.070	7.45	0.00
125	16.586	0.132	1.79	106	-2.34	90	80	-0.070	7.58	0.00
126	16.722	0.136	1.79	106	-2.51	101	80	-0.060	7.08	0.00
127	16.854	0.132	1.79	106	-0.02	92	80	-0.060	6.93	0.00

BOX B TEST DATA - ASTM E2780 / ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 5

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/18/2020

Elapsed Time (min)	Particulate Sampling Data							Flue Gas Data		
	Gas Meter (ft ³)	Sample Rate (cfm)	Orifice dH (in H ₂ O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H ₂ O)	CO ₂ (%)	CO (%)
128	16.987	0.133	1.78	106	-0.43	94	80	-0.060	7.03	0.00
129	17.123	0.136	1.78	106	-0.14	92	80	-0.060	6.86	0.02
130	17.253	0.130	1.78	106	-2.44	93	80	-0.060	7.11	0.00
131	17.390	0.137	1.80	106	-2.76	94	80	-0.070	6.89	0.02
132	17.522	0.132	1.79	106	-0.49	102	80	-0.060	6.93	0.00
133	17.655	0.133	1.80	106	-0.9	102	80	-0.060	6.89	0.00
134	17.790	0.135	1.79	106	-0.17	98	80	-0.070	7.04	0.00
135	17.923	0.133	1.77	106	-2.95	98	80	-0.060	6.89	0.00
136	18.055	0.132	1.78	106	-3.35	95	80	-0.050	7.00	0.00
137	18.191	0.136	1.78	106	-2	96	80	-0.060	6.93	0.00
138	18.323	0.132	1.78	106	-0.39	101	80	-0.060	7.02	0.00
139	18.457	0.134	1.77	106	-3.36	97	80	-0.060	6.98	0.00
140	18.591	0.134	1.78	106	-0.03	97	80	-0.060	6.99	0.01
141	18.723	0.132	1.78	106	-3.12	103	80	-0.060	6.84	0.01
142	18.858	0.135	1.79	106	0	97	80	-0.070	7.02	0.00
143	18.991	0.133	1.79	106	-0.19	96	80	-0.070	7.02	0.00
144	19.124	0.133	1.80	106	-3.34	107	80	-0.070	6.90	0.00
145	19.259	0.135	1.77	106	-0.35	102	80	-0.060	6.94	0.03
146	19.393	0.134	1.78	107	-0.44	98	80	-0.060	6.81	0.02
147	19.524	0.131	1.79	107	-1.49	98	80	-0.050	6.81	0.00
Avg/Tot	19.524	0.133	1.77	101	-1.58	100	79	-0.072	9.90	0.04

WOODSTOVE SURFACE TEMPERATURE DATA

Client: MF Fire
 Model: Nova 2
 Run #: 5

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/18/2020

Stove ΔT: 14

Temperature Data (°F)							
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
0	338	295	316	481	309	347.8	699
1	337	299	316	471	309	346.4	541
2	336	300	316	459	310	344.2	461
3	335	297	315	463	311	344.2	491
4	334	297	315	510	311	353.4	751
5	333	295	315	512	312	353.4	806
6	332	295	315	505	313	352.0	607
7	331	292	314	509	312	351.6	702
8	329	296	315	515	313	353.6	799
9	327	291	313	525	312	353.6	862
10	325	292	312	537	313	355.8	875
11	324	293	312	544	313	357.2	883
12	322	293	311	551	313	358.0	923
13	320	289	310	562	313	358.8	951
14	319	288	309	574	313	360.6	961
15	318	289	308	584	313	362.4	930
16	317	287	307	595	313	363.8	933
17	316	288	305	607	313	365.8	969
18	316	290	304	623	313	369.2	1045
19	315	287	303	638	313	371.2	1050
20	314	284	302	651	313	372.8	1002
21	314	286	302	661	313	375.2	980
22	314	284	301	669	313	376.2	982
23	314	283	300	676	313	377.2	959
24	314	286	299	683	313	379.0	1014
25	313	284	299	691	312	379.8	1021
26	314	285	298	694	312	380.6	968
27	314	286	298	698	312	381.6	998
28	314	287	298	705	312	383.2	1049
29	314	289	297	711	312	384.6	1045
30	315	287	297	716	311	385.2	995
31	316	288	296	719	311	386.0	1023
32	316	290	297	724	311	387.6	1052
33	317	289	297	730	311	388.8	1052
34	318	291	297	736	311	390.6	1040
35	319	292	298	739	311	391.8	1031
36	320	293	297	743	311	392.8	1063
37	322	294	298	748	311	394.6	1035
38	323	294	298	754	311	396.0	1038
39	324	295	299	759	311	397.6	1051
40	325	297	300	765	310	399.4	1056
41	327	298	301	771	311	401.6	1068
42	328	300	301	778	311	403.6	1082
43	330	300	303	783	311	405.4	1079
44	332	301	304	785	312	406.8	1063
45	334	307	306	785	312	408.8	1057
46	335	307	307	786	311	409.2	1066
47	336	306	308	786	311	409.4	1065

WOODSTOVE SURFACE TEMPERATURE DATA

Client: MF Fire
 Model: Nova 2
 Run #: 5

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/18/2020

Stove ΔT: 14

Elapsed Time (min)	Temperature Data (°F)						Stove Surface Average	Catalyst Exit
	FB Left	FB Right	FB Back	FB Top	FB Bottom			
48	338	308	309	785	311	410.2	1057	
49	339	312	311	784	311	411.4	1043	
50	341	303	311	784	311	410.0	1035	
51	343	310	313	780	311	411.4	1024	
52	345	317	315	776	311	412.8	1014	
53	346	315	315	771	310	411.4	1003	
54	347	316	318	762	311	410.8	989	
55	349	314	318	754	310	409.0	968	
56	350	315	319	745	310	407.8	959	
57	351	318	319	735	310	406.6	953	
58	352	317	320	727	309	405.0	947	
59	353	317	321	719	309	403.8	941	
60	353	316	321	711	309	402.0	936	
61	354	317	322	703	309	401.0	929	
62	354	318	323	695	309	399.8	918	
63	355	319	322	690	310	399.2	911	
64	355	318	323	684	310	398.0	907	
65	355	317	323	678	310	396.6	902	
66	355	319	324	673	310	396.2	906	
67	355	318	324	668	310	395.0	901	
68	355	318	323	663	310	393.8	893	
69	356	318	324	661	310	393.8	884	
70	355	317	325	657	311	393.0	881	
71	355	320	326	653	310	392.8	878	
72	355	316	326	650	310	391.4	874	
73	355	317	326	647	310	391.0	874	
74	355	316	326	642	311	390.0	878	
75	355	316	328	639	311	389.8	878	
76	355	316	327	636	311	389.0	878	
77	355	321	329	633	312	390.0	877	
78	356	323	328	630	313	390.0	876	
79	356	322	329	627	312	389.2	872	
80	356	322	331	626	313	389.6	868	
81	356	322	329	622	314	388.6	862	
82	356	322	330	620	313	388.2	858	
83	355	322	331	616	313	387.4	854	
84	355	322	331	614	314	387.2	850	
85	355	321	332	612	314	386.8	848	
86	355	320	332	609	314	386.0	846	
87	355	323	332	607	315	386.4	843	
88	355	321	333	605	315	385.8	843	
89	355	322	333	603	315	385.6	843	
90	355	323	333	603	315	385.8	844	
91	355	325	334	603	316	386.6	846	
92	355	325	335	604	316	387.0	843	
93	355	318	336	603	316	385.6	837	
94	355	320	338	600	315	385.6	830	
95	355	321	339	597	316	385.6	825	

WOODSTOVE SURFACE TEMPERATURE DATA

Client: MF Fire
 Model: Nova 2
 Run #: 5

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/18/2020

Stove ΔT: 14

Elapsed Time (min)	Temperature Data (°F)						Stove Surface Average	Catalyst Exit
	FB Left	FB Right	FB Back	FB Top	FB Bottom			
96	355	323	338	595	316	385.4	827	
97	355	323	338	592	317	385.0	824	
98	355	323	339	589	317	384.6	823	
99	355	323	341	588	317	384.8	823	
100	355	320	342	587	318	384.4	825	
101	355	322	341	586	317	384.2	827	
102	355	321	343	584	317	384.0	825	
103	355	321	344	581	317	383.6	816	
104	355	322	345	577	318	383.4	807	
105	355	315	346	574	318	381.6	802	
106	355	319	347	568	318	381.4	793	
107	354	320	348	565	318	381.0	786	
108	354	319	349	559	318	379.8	780	
109	354	319	350	554	319	379.2	775	
110	354	320	351	551	320	379.2	771	
111	353	320	352	547	320	378.4	767	
112	353	319	352	544	320	377.6	763	
113	352	313	353	540	321	375.8	760	
114	352	318	353	537	322	376.4	756	
115	352	322	354	534	322	376.8	753	
116	351	316	354	532	323	375.2	750	
117	351	312	354	529	322	373.6	748	
118	350	315	353	526	323	373.4	746	
119	350	315	353	524	323	373.0	744	
120	349	317	354	522	323	373.0	743	
121	349	317	354	520	324	372.8	741	
122	348	317	353	517	324	371.8	740	
123	348	315	353	516	325	371.4	735	
124	347	319	354	514	325	371.8	733	
125	347	318	353	513	325	371.2	727	
126	346	315	354	511	326	370.4	720	
127	346	317	354	509	326	370.4	716	
128	345	314	355	508	326	369.6	714	
129	345	314	355	506	327	369.4	713	
130	344	315	354	504	327	368.8	712	
131	344	318	353	502	327	368.8	711	
132	343	314	354	500	328	367.8	709	
133	342	318	354	499	328	368.2	708	
134	342	317	354	497	329	367.8	707	
135	342	314	353	496	330	367.0	707	
136	341	317	354	495	330	367.4	706	
137	341	318	354	494	330	367.4	706	
138	340	309	353	492	330	364.8	706	
139	339	314	353	491	330	365.4	705	
140	338	312	353	490	330	364.6	705	
141	338	313	353	489	331	364.8	704	
142	338	314	353	488	332	365.0	704	
143	338	309	351	488	331	363.4	705	

WOODSTOVE SURFACE TEMPERATURE DATA

Client: MF Fire
 Model: Nova 2
 Run #: 5

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/18/2020

Stove ΔT: 14

Temperature Data (°F)							
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
144	337	312	351	487	332	363.8	704
145	336	310	351	485	332	362.8	705
146	336	313	351	484	332	363.2	705
147	335	307	351	483	332	361.6	705
Average	341	309	328	613	316	382	861

LAB SAMPLE DATA - ASTM E2515

Client: MF Fire
 Model: Nova 2
 Run #: 5

Job #: 20-606
 Tracking #: 74
 Technician: A Kravitz
 Date: 6/18/2020

	Sample ID	Tare, mg	Total, mg	Final, mg	Catch, mg
Train A Filters - First Hour	A029	120.0	120.0	121.4	1.4
Train A Filters - Remainder	A030	118.3	237.8	239.0	1.2
	A031	119.5			
Train A Probe	13A	117457.5	117457.5	117458.3	0.8
Train A O-Rings	13A	3356.2	3356.2	3356.7	0.5
Train B Filters	A032	119.6	239.3	241.6	2.3
	A033	119.7			
Train B Probe	13B	117055.9	117055.9	117056.2	0.3
Train B O-Rings	13B	3340.7	3340.7	3341.5	0.8
Background Filter			0.0	0.0	

Placed in Dessicator on:

Train A Filters - First Hour	121.6	6/25 15:14	121.4	6/29 9:21		
Train A Filters - Remainder	239.2	6/25 15:14	239.0	6/29 9:20		
Train A Probe	117458.5	6/25 15:06	117458.3	6/29 9:11		
Train A O-Rings	3356.7	6/25 15:15	3356.7	6/29 9:17		
Train B Filters	241.7	6/25 15:15	241.6	6/29 9:20		
Train B Probe	117056.3	6/25 15:07	117056.2	6/29 9:11		
Train B O-Rings	3341.7	6/25 15:15	3341.5	6/29 9:17		
Background Filter						

1st hour Sub-Total, mg:	1.4
Remainder Sub-Total, mg:	2.5
Train 1 Aggregate, mg:	3.9
Train 2 Aggregate, mg:	3.4
Ambient Aggregate, mg:	0.0

ASTM E2515 - Glass Filters

Sample	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
A001	118.3	118.1	-	-	SB	20-565	#1
A002	119.3	119.1	-	-	SB	↓	↓
A003	119.4	119.5	-	-	SB	↓	#2
A004	118.3	118.2	-	-	SB	↓	↓
A005	119.5	119.6	-	-	SB	↓	#3
A006	119.6	119.7	-	-	SB	↓	↓
A007	119.0	118.9	-	-	SB	↓	#4
A008	118.8	118.9	-	-	SB	↓	↓
A009	119.4	119.5	-	-	SB	20-606	#1
A010	118.8	118.7	-	-	SB	↓	↓
A011	119.5	119.3	-	-	SB	↓	↓
A012	120.3	120.3	-	-	SB	↓	↓
A013	120.6	120.5	-	-	SB	↓	↓
A014	120.5	120.6	-	-	SB	20-606	#2
A015	120.5	120.5	-	-	SB	↓	↓
A016	120.0	120.0	-	-	SB	↓	↓
A017	119.6	119.8	-	-	SB	↓	↓
A018	121.2	121.4	-	-	SB	↓	↓

Weight 1 Date/Time:
4/27- 13:00
Weight 2 Date/Time:
4/28- 8:00
Weight 3 Date/Time:
Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
A019	118.6	118.5	-	-	SB	20-606	#3
A020	119.9	119.7	-	-	SB	↓	↓
A021	120.4	120.3	-	-	SB	↓	↓
A022	119.0	119.0	-	-	SB	↓	↓
A023	119.5	119.4	-	-	SB	↓	↓
A024	119.7	119.5	-	-	SB	20-606	#4
A025	120.2	120.3	-	-	SB	↓	↓
A026	118.6	118.5	-	-	SB	↓	↓
A027	118.5	118.5	-	-	SB	↓	↓
A028	119.6	119.7	-	-	SB	↓	↓
A029	119.9	120.0	-	-	SB	20-606	#5
A030	118.4	118.3	-	-	SB	↓	↓
A031	119.6	119.5	-	-	SB	↓	↓
A032	119.7	119.6	-	-	SB	↓	↓
A033	119.2	119.7	-	-	SB	↓	↓
A034	117.4	117.5	-	-	SB	↓	↓
A035	121.1	121.0	-	-	SB	↓	↓
A036	119.2	119.3	-	-	SB	↓	↓

Weight 1 Date/Time:
4/27- 13:00
Weight 2 Date/Time:
4/28- 8:00
Weight 3 Date/Time:
Weight 4 Date/Time:

ASTM E2515 - Probes

Sample	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
1A	115628.0	115627.9	-	-	A	20-565	#4
1B	1159011.6	115900.4	-	-	L		
2A	116239.6	116239.5	-	-	A	20-601	#1
2B	116328.7	116328.5	-	-	L		
3A	116074.0	116073.9	-	-	1	20-601	#2
3B	116338.8	116338.9	-	-	-		
4A	116183.2	116182.0	116183.1	-	A	20-601	#3
4B	116366.4	116366.4	116366.6	-	A		
5A	116767.1	116766.4	116767.0	-	A	-	-
5B	116874.9	116874.4	116874.6	-	L	-	-

Weight 1 Date/Time:
4/23 17:00

Weight 2 Date/Time:
4/24 08:30

Weight 3 Date/Time:
4/26 09:30

Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
6A	116544.0	116543.9	-	-	SB	20-604	#1
6B	116118.2	116118.1	-	-	SB		
7A	116739.4	116739.3	-	-	SB	20-604	#2
7B	117286.9	117286.8	-	-	SB		
8A	116829.8	116829.7	-	-	SB	20-604	#3
8B	116827.0	116826.5	116826.6	-	SB		
9A	116713.3	116713.7	-	-	SB	20-606	#1
9B	117918.8	117918.6	-	-	SB		
10A	116819.6	116819.7	-	-	SB	20-606	#2
10B	117903.6	117903.5	-	-	SB		

Weight 1 Date/Time:
5/26/20 8:00

Weight 2 Date/Time:
5/27/20 9:00

Weight 3 Date/Time:
5/28/20 8:00

Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
11A	117036.5	117036.7	-	-	SB	20-606	#3
11B	117490.8	117490.9	-	-	SB		
12A	116890.0	116890.0	-	-	SB	20-606	#4
12B	117942.2	117942.0	-	-	SB		
13A	117457.6	117457.5	-	-	SB	20-606	#5
13B	117056.1	117055.9	-	-	SB		
14A	-	116818.1	116818.1	-	A	-	-
14B	-	116771.7	116771.6	-	L	-	-
15A	-	117418.5	117418.7	-	L	-	-
15B	-	116905.3	116906.0	-	L	-	-

Weight 1 Date/Time:
6/8-9:30

Weight 2 Date/Time:
6/9-9:30

Weight 3 Date/Time:
6/15 11:15

Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
16A							
16B							
17A							
17B							
18A							
18B							
19A							
19B							
20A							
20B							

Weight 1 Date/Time:

Weight 2 Date/Time:

Weight 3 Date/Time:

Weight 4 Date/Time:

ASTM E2515 - O-Rings

Sample	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
1A	3579.6	3566.2	3566.7	3566.8	A	20-565	#4
1B	3554.6	3554.0	3555.0	-	A		
2A	3552.4	3552.5	-	-	A	20-601	#1
2B	3571.5	3571.6	-	-	A		
3A	3579.7	3579.8	-	-	A	20-601	#2
3B	3564.0	3568.2	-	-	A		
4A	3622.1	3623.6	3623.8	-	A	20-601	#3
4B	3570.9	3580.2	3580.7	-	A		
5A	3534.1	3534.9	3535.0	-	A		
5B	3530.6	3531.4	3531.5	-	A		

Weight 1 Date/Time: 4/23 16:00
Weight 2 Date/Time: 4/24 0830
Weight 3 Date/Time: 4/25 12:00
Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
6A	3612.5	3612.6	-	-	SB	20-604	#1
6B	3390.9	3392.0	3392.1	-	SB		
7A	3570.5	3570.6	-	-	SB	20-604	#2
7B	3520.2	3520.2	-	-	SB		
8A	3549.9	3549.6	3549.7	-	SB	20-604	#3
8B	3583.8	3583.3	3583.4	-	SB		
9A	3579.4	3579.4	-	-	SB	20-606	#1
9B	3522.4	3522.5	-	-	SB		
10A	3426.0	3426.8	3426.8	-	SB	20-606	#2
10B	3568.5	3568.6	-	-	SB		

Weight 1 Date/Time: 5/26/20 - 8:00
Weight 2 Date/Time: 5/27/20 - 9:00
Weight 3 Date/Time: 5/28/20 - 8:00
Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
11A	3416.1	3417.3	3417.5	-	A	20-606	#3
11B	4228.1	4229.3	4229.5	-	A		
12A	3398.9	3399.8	3399.0	-	A	20-606	#4
12B	3391.8	3392.1	3392.0	-	A		
13A	3355.8	3356.1	3356.2	-	A	20-606	#5
13B	3439.9	3440.5	3440.7	-	A		
14A	-	3362.5	3362.7	-	A		
14B	-	3337.2	3337.4	-	A		
15A	-	3567.6	3567.6	-	A		
15B	-	3568.4	3568.6	-	A		

Weight 1 Date/Time: 6/8 - 9:30
Weight 2 Date/Time: 6/10 - 8:00
Weight 3 Date/Time: 6/15 - 11:15
Weight 4 Date/Time:

Sample	Weight 1	Weight 2	Weight 3	Weight 4	Initial	Project	Run
16A							
16B							
17A							
17B							
18A							
18B							
19A							
19B							
20A							
20B							

Weight 1 Date/Time:
Weight 2 Date/Time:
Weight 3 Date/Time:
Weight 4 Date/Time:

Photos



Fuel 1



1 Fuel 21 loaded



1 loaded 2



1 loaded



2 fuel



2fuel



2 loaded



2 loaded 2



3 fuel

3 fuel 2



3 fuel 2



3 loaded



3 loaded 2



4 fuel



4 fuel 2



4 loaded



4 loaded 2



5 fuel



5 fuel 2



5 loaded



5 loaded 2

Appendix B

Labels and Manuals

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 2
Model #002**

**Serial
Number**

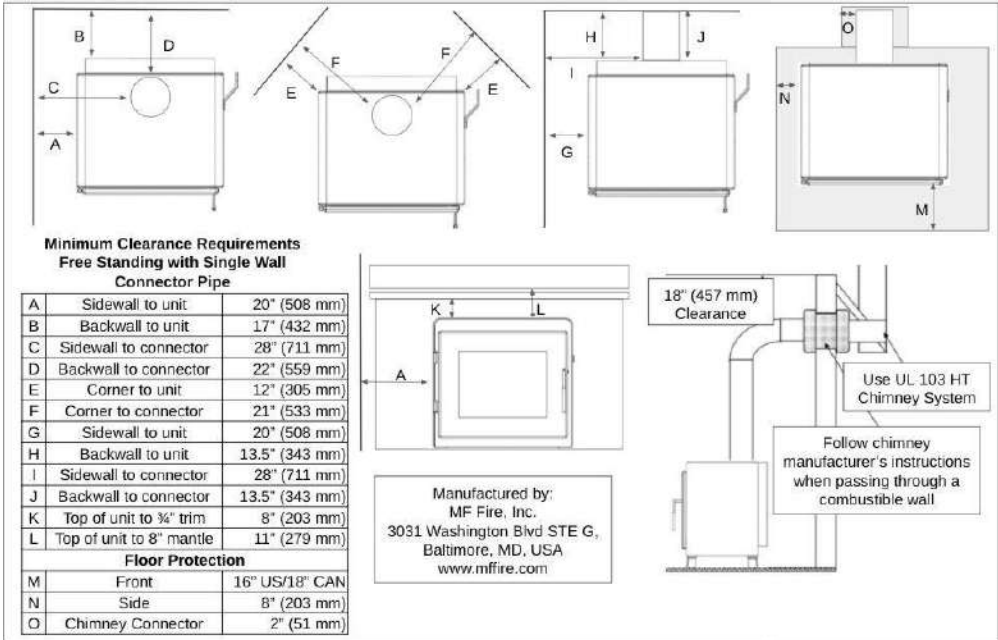
Solid Fuel Room Heater
Report Number F20-590

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 needs periodic inspection and repair for proper operation. Consult the owner's manual for further information. It is against federal regulations to operate this wood heater in a manner inconsistent with the operating instructions in the owner's manual.

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 equipped with 6" legs and 6" ash lip, Nova equipped with 9" legs, and for all Nova Tower configurations, only Type 1 ember protection is required. For Nova 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 hearts only.



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 1.93 g/hr, tested to EPA Method 28R and ASTM E2515-11

Made in U.S.A

DATE OF MANUFACTURE: _____

NOVA 2 AND NOVA 2 TOWER OWNER'S MANUAL



Safety Notice: Please save these instructions for future reference. 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 2 in a mobile home!

Manufactured by:
MF Fire, Inc.
3031 Washington Blvd STE G,
Baltimore, MD, USA



Report Number XXX-XXX

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Safety Precautions

Installation

Nova 2 must be properly installed to prevent house fires. Please strictly adhere to the installation instructions.

Nova 2 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 2 in conjunction with any air distribution ductwork unless specifically approved for such installations.

Operation

Nova 2 is hot while in operation. Keep children, clothing and furniture away as contact may cause skin burns.

Do not touch Nova 2 while hot. Young children should be supervised around Nova 2.

Keep all flammable objects (fabrics, paper, wood, etc.) at least 1 yd (1 m) from the front of the Nova 2.

Nova 2 has been designed for the burning of cordwood only. Do not attempt to burn any other type of fuel in Nova 2.

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 2 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.

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.

Never over-fire Nova 2, as it could lead to a house fire. If the unit or chimney connector glows, you have over-fired the unit.

Maintenance

Allow Nova 2 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 2



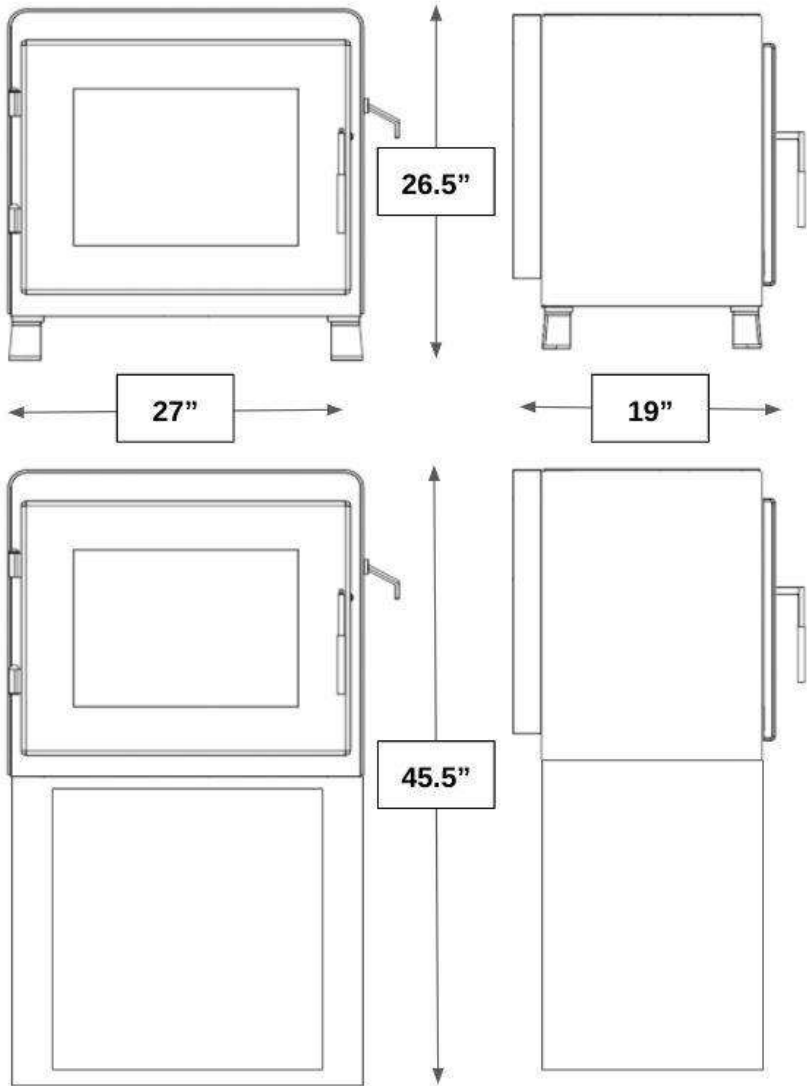
Nova 2 Tower

Nova 2 is available in two configurations, Nova 2 and Nova 2 Tower. Nova 2 can be optionally equipped with 3" (standard, shown above), 6", or 9" legs. Nova 2 Tower is available with no legs (standard, shown above) or 6" legs.

Additionally, both Nova 2 and Nova 2 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 2 is equipped with a 2.4 ft.³ firebox and accepts logs up to 22” in length.

Nova 2 has a 2,500 sq. ft. (175 m²) approximate maximum heating capacity. Heating capacity will vary depending on the home's floor plan, degree of insulation, and the outside temperature.

Nova 2 has a 35,000 BTU per hour (10 kW) EPA certified heat release rate, with actual heat release rates ranging from 13,000 to 75,000 BTU per hour (4 to 22 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. Certified average emissions rate of 1.93 g/hr and a maximum tested efficiency of 81% LHV and an HHV efficiency of 75.2% tested to EPA Method 28R and ASTM E2515-11.

Safety Listings

Nova 2 is available for sale in the United States and Canada has been listed with PFS-TECO and is tested and compliant in accordance with UL 1482 – 2011(R2015), ULC-S627-00 (R2016), and ULC S628-93 (R2016)

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 2 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 2 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 2 must be placed in a room with a source of fresh air.

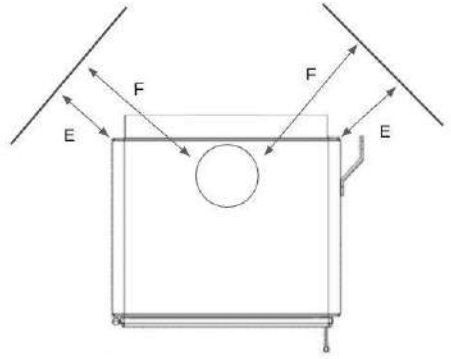
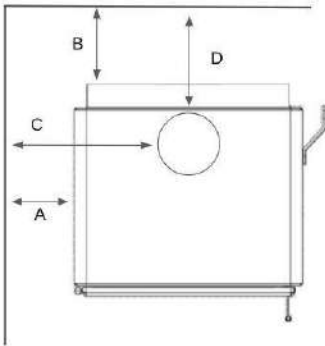
Nova 2 must be placed so that no combustibles are within, or can swing within 36" (914mm) of the front of the stove (drapes, doors, etc.).

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 Requirements

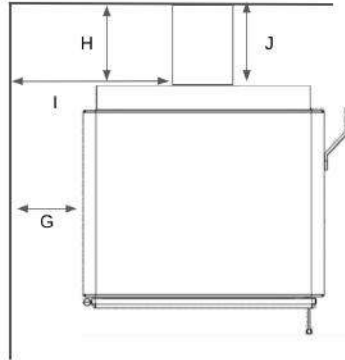
Nova 2 may be installed as a top vent with a ceiling exit in either a standard or corner configuration, or as a rear vent with a direct rear exit. The minimum clearance requirements are listed in the table below. Clearances may be reduced following methods in NFPA 211, listed wall shields, pipe shields, or other means approved by local building or fire officials.

Top vent, ceiling exit



A	Sidewall to unit	20" (508 mm)
B	Backwall to unit	17" (432 mm)
C	Sidewall to connector	28" (711 mm)
D	Backwall to connector	22" (559 mm)
E	Corner to unit	12" (305 mm)
F	Corner to connector	21" (533 mm)

Rear vent, rear exit

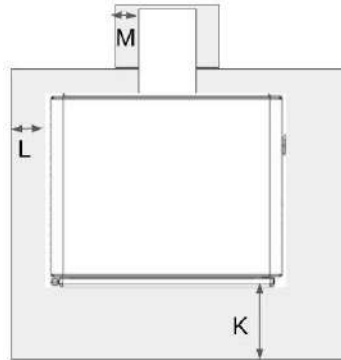


G	Sidewall to unit	20" (508 mm)
H	Backwall to unit	13.5" (343 mm)
I	Sidewall to connector	28" (711 mm)
J	Backwall to connector	13.5" (343 mm)

Floor Protection Requirements

Nova 2 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 Clearances



K	Floor protection from front	16"US/18" CAN (406/457 mm)
L	Floor protection from side	8" (203 mm)
M	Floor protection from chimney connector	2" (51 mm)

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 2 equipped with 6" legs and ash lip, Nova 2 equipped with 9" legs, and for all Nova 2 Tower configurations, only Type 1 ember protection is required. For Nova 2 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

Do not connect Nova 2 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:

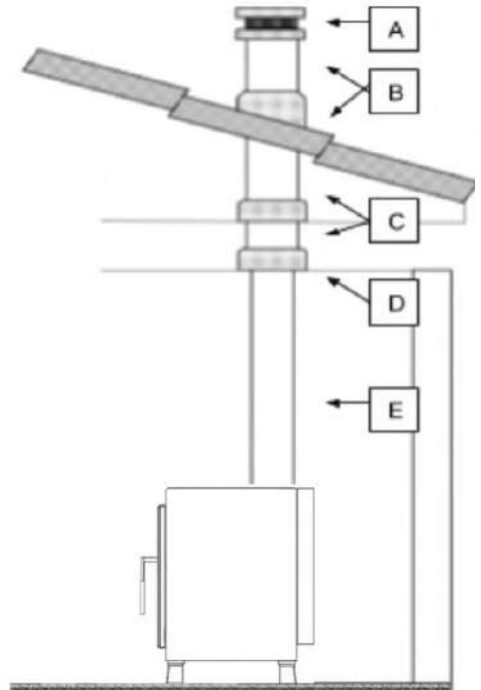
1. A 6" (150 mm) diameter, UL 103 HT chimney, from a single manufacturer

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

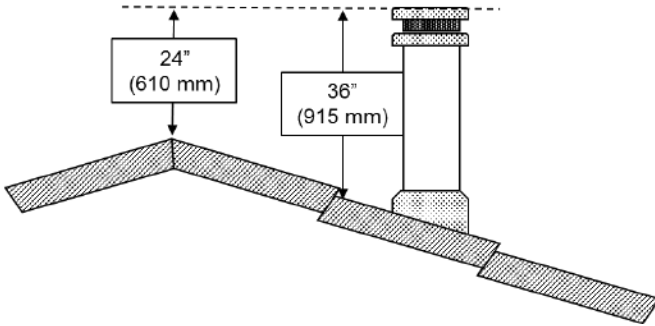


Chimney Termination Requirements

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).

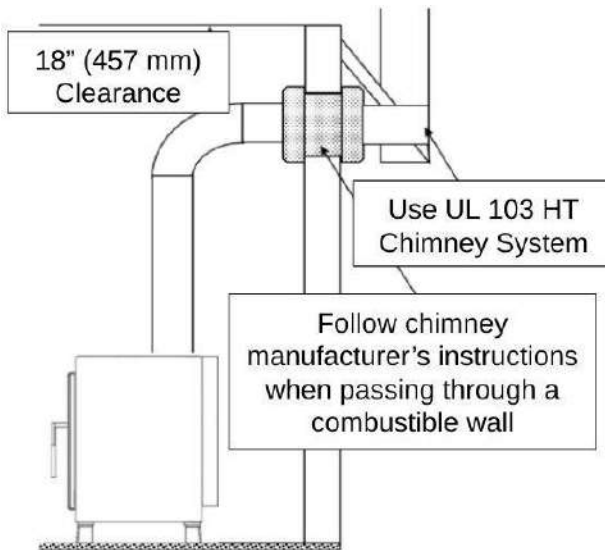


Special Installation: Exterior Factory-Built Chimney

Nova 2 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.

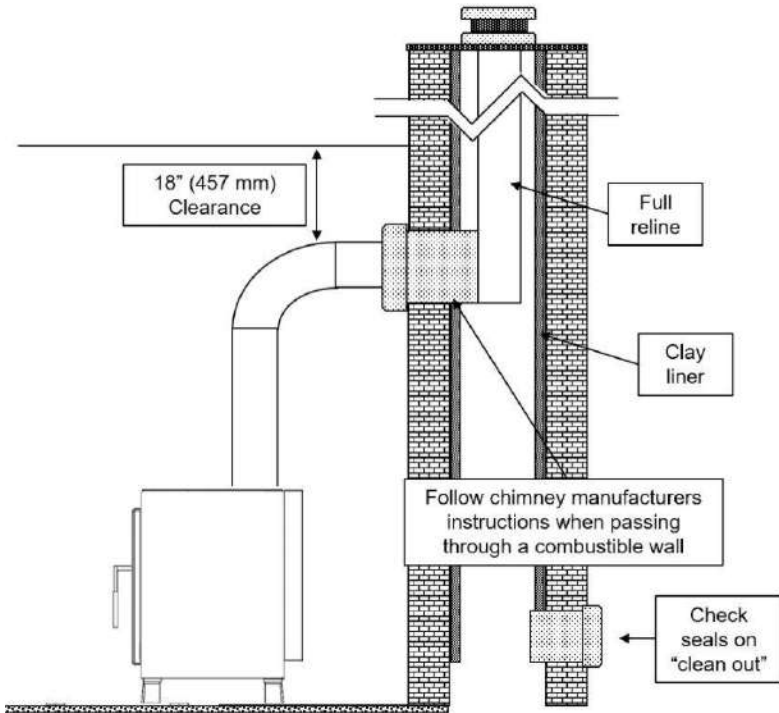
Floor protection is required 2" on both sides of the chimney connector for any horizontal runs.



Special Installation: Masonry Chimney

Nova 2 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 2 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.

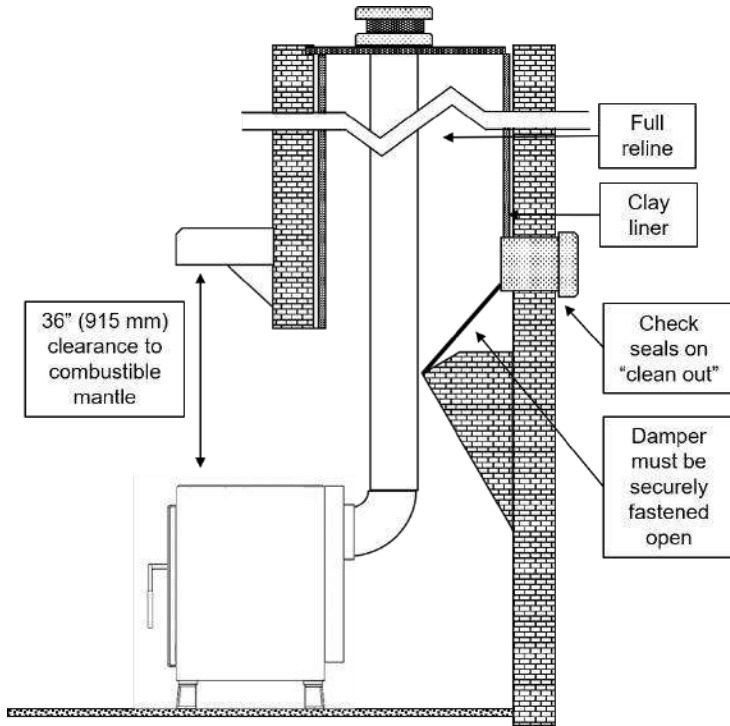


Special care must be taken regarding the wall thimble, or penetration from the chimney connector pipe to the masonry chimney, if the wall thimble must pass through a combustible exterior wall. Here all chimney manufacturer's instructions must be followed, including guidance on spacing to combustible surfaces, piping requirements, and liner requirements. Check with local authorities before installation to ensure all requirements are met.

Special Installation: Masonry Fireplace

Nova 2 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.



Configuring the Optional Top or Rear Vent

Nova 2 can be configured as either a top venting or a rear venting stove. Nova 2 will arrive in the rear vent configuration. To switch to the top vent configuration, the following procedure may be followed.

Step 1: Remove the flue 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 covering plate, secured with 4 bolts and 2 washers each, located on the inside top of the stove.

Step 3: The flue collar that was removed from the back of the stove can then be inserted into 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 ash shown below.



Step 4: Replace the access plate and cover the opening with the blocker plate.

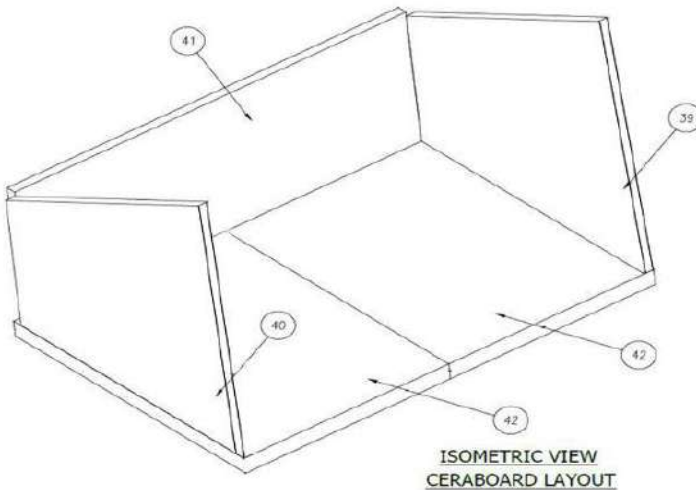
Installing the Ceramic Fiberboard and Fire Brick

Nova 2 comes equipped with a two part insulation strategy to maintain clean, efficient fires and a long lasting coal bed. The ceramic fiberboard maintains efficient and long lasting heat while the firebricks provide a durable platform for your fire and maintain smooth even heating.

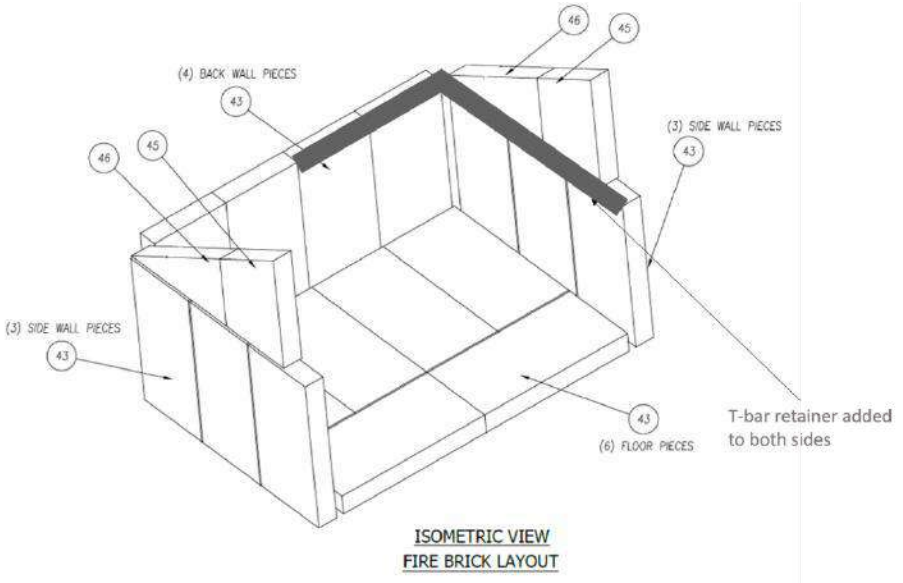
The fiberboard and bricks must be installed before the first fire and should be installed following the procedure below. Gloves and safety glasses should be worn during installation.

Step 1: Unpack the bricks and ceramic fiberboard that accompany your Nova 2, and ensure all pieces are present. The ceramic fiberboard and bricks received with your stove may not have the corresponding numbers in steps below.

Step 2: Insert ceramic fiberboard as shown below. First, the two bottom boards (42) are installed. Next the rear wall is installed (41). Then the sidewalls (39 and 40) are installed. Gentle pressure may be needed to press the boards into place. Some small bending and cracking is not unusual or a problem.



Step 3: Next, install the fire bricks. The first bricks to be installed should be the four rear wall bricks and then the three bricks on the left and right side wall. A small gap may exist in between the corner of the bricks as shown in the diagram. Next, install the six bricks on the floor of Nova 2. 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 to both sides of the stove.



It is normal to have small gaps between the bricks upon completion. The bricks can be shifted towards the rear of the fire box.

Catalytic Combustor

The Nova 2 catalytic combustor 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 2 may not be operated without the catalytic combustor properly installed. To prevent improper operation, Nova 2 has a special catalytic combustor door that stops airflow if the catalytic combustor is improperly installed.

To install the catalytic combustor follow the steps below.

Step 1: Remove the packaging surrounding the catalytic combustor.

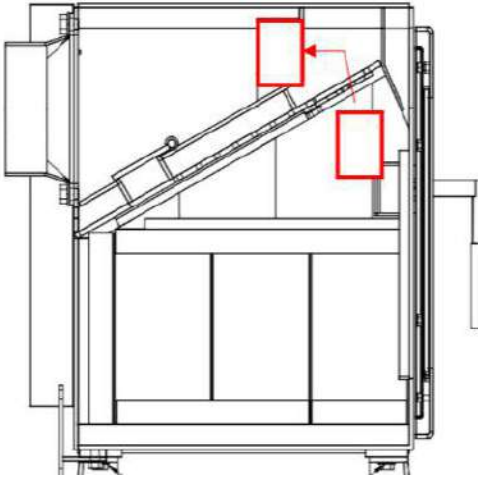


Step 2: Unscrew the two bolts holding in the flame shield, the thick piece of metal located on the inside top of the stove at the front most portion of the baffle. Set the flame shield to the side.





Step 3: 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 4: 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 5: Insert the catalytic combustor retaining peg in the front of the catalytic combustor

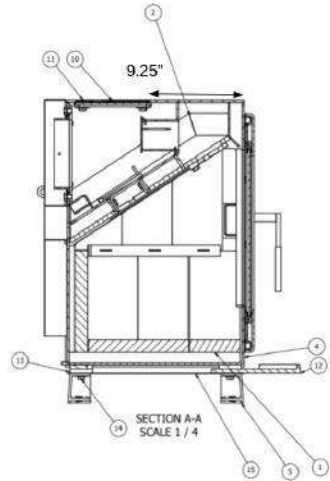
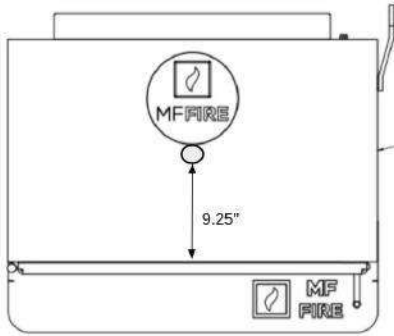
Step 6: Reinstall the flame shield

Ash Lip

The optional ashlip is installed on the front of Nova 2 and slots between the legs and the leg pads. To install the ash lip, loosen the bolts securing Nova 2's legs, slide the ashlip between the legs and the leg pads, and then tighten.

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 2. The thermometer should be placed on the stove top, 9.25" from the front of the stove and centered on 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 2 is built to be simple and easy to use. It just works. We designed Nova 2 with no dampers to play with and so there is no need to try over and over again to light a fire. Just build a fire, sit back and enjoy.

Starting a Fire

We strongly recommend a top-down fire for burning in Nova 2. 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 below) 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.

When the fire is well established, you can close the door, and when the Catalyst Thermometer reads “ENGAGE CATALYST” you can engage the catalyst by moving the bypass lever.

Bypass

Nova 2 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 opened prior to opening the front-loading door. After loading or reloading your stove with wood, the bypass should remain open until the thermometer provided reads “ENGAGE CATALYST”. The normal closed position is when the bypass lever is to the rear of the stove.

Controlling the Burn

Your Nova 2 has only one burn mode – perfect. If you would like more or less heat out of your Nova 2, simply load more or less wood into your stove.

Reloading

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, wait 10-15 seconds for the exhaust gases to re-stabilize, and 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 2. 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 2.

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 2, 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 2, 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 2 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. Color match paint can be ordered directly from MF Fire. Contact us at support@mffire.com and tell us the color you need, and we will ship it right out to you.

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 MF Fire at support@mffire.com 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 2 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 MF Fire for a replacement catalytic combustor (Part Number: Nova 2-CAT) at support@mffire.com.

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 2 Tower Assembly

Nova 2 Tower ships with the Nova 2 stove, a Nova 2 Tower Pedestal, an optional Nova 2 Tower Shroud and optionally 6” pedestal legs.

To assemble the Nova 2 Tower, follow all instructions and guidelines above and the additional guidance below. Please note, Nova 2 must be attached to the Nova 2 Tower Pedestal before the installation of ceramic fiberboard and firebricks.

Attaching the Nova 2 Tower Pedestal

CAUTION: Nova 2 and Nova 2 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 2 Tower 6” legs, carefully rotate the Nova 2 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 2 Tower Pedestal into the upright position and place in its final position. Follow all requirements in the Stove Placement Requirements section. Your Nova 2 Tower must be level and sturdy prior to continuing to Step 4.

Step 4: Your Nova 2 wood stove will come with legs attached to it. These must be removed prior to placing the Nova 2 on top of the Nova 2 Tower Pedestal. Carefully rotate the Nova 2 on to its left or right sides (not front or back) on to a soft surface. Be sure all moving parts are secured before rotating (front door, rear air duct, bypass handle).

Step 5: Remove the bolts, washers, and legs from the bottom of Nova 2 using a socket or adjustable wrench. Save these bolts and washers for a later step.



Step 6: Carefully place Nova 2 on top of the Nova 2 Tower Pedestal ensuring the leg pad holes are aligned with the holes on top of the pedestal. The front of the Nova 2 should face the same direction as the wood storage opening of the pedestal.



Step 7: Using gloves, remove the metal heat shield and ceramic fiberboard insulation above it on the top underside of the Nova 2 Tower Pedestal. Using a socket or adjustable wrench, secure the Nova 2 stove to the Nova 2 Tower Pedestal from the underside using the same bolts that previously secured the legs to underside of Nova 2 and the new heavier washers supplied with the Nova 2 Tower. At this point, Nova 2 should be very secure to the Nova 2 Tower Pedestal.



Step 8: Using gloves, place the piece of ceramic fiberboard insulation and sheet metal shield into the top of the pedestal in the same position it was located before bolting Nova 2 to the base. 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 9: 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



Attaching the Nova 2 Tower Shroud

The Nova 2 Tower Shroud is contained within its own cardboard packaging and cannot be installed until your Nova 2 Tower has been fully assembled.

Step 1: In preparation for assembly, select an area on a rug, or place a large blanket on the floor to protect the floor while providing cushion for the shroud components. Remove all parts from the box and organize in the designated floor area.



Step 2: Stand the U-shaped top of the shroud on its side. Take the side panel without the cutout and place it on its side, with the flange end (side with screw holes) aligned with the screw holes of the top shroud piece. The side panel goes on the inside. Match up the holes on the top and side panels.



Step 3: Using a Phillips head screwdriver and attach 3 screws (included) to fasten the top and side panel together. The attached panel will look like the image below. Repeat this process to attach the remaining panel to the top.



Step 4: Place the two support bars on top of your Nova 2 Tower as shown. There are two ways to place the support bars. We recommend Option 1 in most scenarios, but Option 2 may also be used if it is more aesthetically pleasing.

Option 1



Option 2



Step 5:

NOTE: This step requires a second person to avoid scratching the stove or shroud.

Carefully lift the completed shroud from the floor by grasping the shroud near the screw holes on the front and back. Walk the shroud over the top of the Nova 2 Tower as shown. Extra care needs to be taken on the shroud side with the bypass cutout. You may need to partially move the bypass handle out of the way while lowering the shroud into place as shown below. You will need to gently press the top of the shroud into place, making any adjustment to support bars to maintain proper spacing.



Step 6: Use the included magnets to maintain spacing and restrict movement between Nova 2 Tower and the shroud. Place magnets in the following locations, as you face the shroud from the front of the stove. Use your finger to gently position the magnets between the stove and the shroud.

- a. Left shroud panel
 - i. Front of panel
 - 1. High
 - 2. Middle
 - 3. Low
 - ii. Rear of panel
 - 1. Low
- b. Right shroud panel
 - i. Front of panel
 - 1. High
 - 2. Middle
 - 3. Low
 - ii. Rear of panel
 - 1. Low
 - 2. Above bypass
 - 3. Below bypass



- c. Place remaining magnets, if needed, in any location between the shroud and stove to help the shroud remain solidly in place.

Appendix B: Lifetime Limited Warranty

To register your Nova 2, go to mffire.com/myproduct to fill out your name, product type, serial number and installation pictures. Please provide numerous pictures of your new beautiful installation. All portions of the stove are subject to the warranty, excluding paint, gasket, glass, fasteners, catalytic combustor, and room blower fan. The room blower fan is subject to a 1-year limited warranty and the catalytic combustor is subject to a 5-year limited warranty also subject to sections A. and B. below. Mileage and service charges, if necessary, are not covered by this warranty.

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 Nova 2 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 Nova 2 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. 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.
9. 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.
10. Damage to the surfaces from over-firing is not covered in this warranty.
11. 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.
12. 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 2.
13. 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.
14. MF Fire will not cover the cost of the removal or re-installation of hearths, facing, mantels, venting or other components.
15. 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.

Appendix C

Equipment

Calibrations



QUALITY CONTROL SERVICES

LABORATORY EQUIPMENT • SALES • SERVICE • CALIBRATION • REPAIRS
2340 SE 11TH Ave. Portland, Oregon 97214 • Box 14831 Portland, Oregon 97293
(503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com



PFS Teco
11785 SE Hwy 212 STE#305
Clackamas, OR 97015

Report Number: DIRI01A05026191031

A2LA ACCREDITED CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Scale	Rice Lake	IQ+355E-2A x 100C	A05026	#041	Lab
Units	Readability	SOP	Cal Date	Last Cal Date	Cal Due Date
lbs	0.1	QC033	10/31/19	6/10/19	6/2020

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	0.3	HB44	HB44	100	0.1	Good	Fair	Poor
As-Found:		As-Found:		As-Found:		Temperature: 10°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	1001.2	1000.4	0.12
700	700.4	700.1	0.12
500	500.2	499.9	0.08
300	300.0	299.9	0.08
100	100.0	99.9	0.05
50	50.0	50.0	0.05

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	Rice Lake	.001 to 10lb	PW0990	10/4/18	10/2020	20181977

Permanent Information Concerning this Equipment:

10/19 New platform. Rice Lake sn# 128929

Comments/Information Concerning this Calibration

10/19 RH = 40%.

Report prepared/reviewed by: R. B. Date: 10-31-19

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.



QUALITY CONTROL SERVICES

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PFS Teco
 11785 SE Hwy 212 STE#305
 Clackamas, OR 97015

Report Number: DIRI01D01487W16P190610

A2LA ACCREDITED CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Scale	Digi-Weigh	DWP-440 400 x 0.1	D01487W16P	N/A	Lab
Units	Readability	SOP	Cal Date	Last Cal Date	Cal Due Date
lbs	0.1	QC033	6/10/19	N/A	6/2020

FUNCTIONAL CHECKS

SHIFT TEST		LINEARITY		REPEATABILITY		ENVIRONMENTAL CONDITIONS		
Test Wt:	Tol:	Test Wt:	Tol:	Test Wt:	Tol:			
100	0.5	HB44	HB44	50	0.1			
As-Found:		As-Found:		As-Found:				
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"/>	<input type="checkbox"/> Good <input checked="" type="checkbox"/> Fair <input type="checkbox"/> Poor		
As-Left:		As-Left:		As-Left:		Temperature: 20.6°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"/>			

CALIBRATION DATA

Standard	As-Found	As-Left	Expanded Uncertainty
400	400.22	400.00	0.08
300	300.19	300.00	0.08
200	200.15	200.00	0.08
100	100.09	100.00	0.05
50	50.04	50.00	0.05
25	25.02	25.00	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	11/24/17	11/2019	20172265

Permanent Information Concerning this Equipment:

12 month calibration cycle

Comments/Information Concerning this Calibration

6/19 RH= 47%. Adjusted span.

Report prepared/reviewed by: ServiceTech Date: 6/11/19

Technician: J. Colacchio

Signature: _____

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.

Dry Gas Meter Calibration

Meter Manufacturer: Apex
 Model: XC-60-ED
 Lab ID #: 53
 Serial #: 1902130
 Calibration Date: 1/23/2020
 Calibration Expiration: 7/23/2020
 Barometric Pressure: 29.93 in. Hg



Reference Standard DGM	
Manufacturer:	Apex
Model:	SK25DA
Lab ID#:	47
Serial #:	1101001
Calibration Expiration Date:	3/13/2020
Calibration γ Factor:	0.998

Unit Under Test Previous Calibration	
Date	6/14/2019
γ Factor:	0.999
Allowable Deviation ($\pm 5\%$):	0.04995
Actual Deviation:	0.01
Result:	PASS

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	162.364	142.013	148.622
Standard DGM Temperature ($^{\circ}$ F)	69.0	70.0	70.0
Standard DGM Pressure (in H ₂ O)	0.00	0.00	0.0
DGM Initial Volume (ft ³)	0.000	0.000	0.000
DGM Final Volume (ft ³)	5.814	5.147	5.409
DGM Temperature ($^{\circ}$ F)	88.0	94.0	96.0
DGM Pressure (in H ₂ O)	3.42	2.04	1.0
Time (min)	32.0	36.0	52.0
Net Volume for Standard DGM (ft ³)	5.734	5.015	5.249
Net Volume for DGM (ft ³)	5.814	5.147	5.409

Dry Gas Meter γ Factor	1.011	1.011	1.013
γ Factor Deviation From Average	1.011	1.011	1.013

Average Gas Meter γ Factor

1.012

Calculations:

- Deviation = |Average value for all runs - current run value|
- $\gamma = [V_{std} \times (\gamma_{std}) \times (P_{bar} + P_{std}/13.6) \times (T_{DGM} + 460)] / [V_{DGM} \times (T_{std} + 460) \times (P_{bar} + P_{DGM}/13.6)]$

Standard Reference Meter is calibrated to NIST traceable standards. Uncertainty of measurement is $\pm 0.5\%$.

Dry Gas Meter Calibration

Meter Manufacturer: Apex
 Model: XC-60-ED
 Lab ID #: 54
 Serial #: 1902133
 Calibration Date: 1/23/2020
 Calibration Expiration: 7/23/2020
 Barometric Pressure: 23.93 in. Hg



Reference Standard DGM	
Manufacturer:	Apex
Model:	SK25DA
Lab ID#:	47
Serial #:	1101001
Calibration Expiration Date:	3/13/2020
Calibration γ Factor:	0.998

Unit Under Test Previous Calibration	
Date	6/14/2019
γ Factor:	0.996
Allowable Deviation ($\pm 5\%$):	0.0498
Actual Deviation:	0.01
Result:	PASS

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	153.663	172.691	287.542
Standard DGM Temperature ($^{\circ}$ F)	69.0	69.0	69.0
Standard DGM Pressure (in H ₂ O)	0.00	0.00	0.0
DGM Initial Volume (ft ³)	0.000	0.000	0.000
DGM Final Volume (ft ³)	5.576	6.296	10.530
DGM Temperature ($^{\circ}$ F)	95.0	95.0	96.0
DGM Pressure (in H ₂ O)	3.60	2.00	1.0
Time (min)	30.0	45.0	99.0
Net Volume for Standard DGM (ft ³)	5.427	6.099	10.154
Net Volume for DGM (ft ³)	5.576	6.296	10.530
Dry Gas Meter γ Factor	1.008	1.008	1.008
γ Factor Deviation From Average	1.008	1.008	1.008

Average Gas Meter γ Factor 1.008

Calculations:

- Deviation = |Average value for all runs - current run value|
- $\gamma = [V_{std} \times (\gamma_{std}) \times (P_{bar} + P_{std}/13.6) \times (T_{DGM} + 460)] / [V_{DGM} \times (T_{std} + 460) \times (P_{bar} + P_{DGM}/13.6)]$

Standard Reference Meter is calibrated to NIST traceable standards. Uncertainty of measurement is $\pm 0.5\%$.

Technician:



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PFS Teco
 11785 SE Hwy 212 STE#305
 Clackamas, OR 97015

Report Number: DIR10134307497200110

A2LA ACCREDITED CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	ENTRIS224-1S	34307497	#107	Lab
Units	Readability	SOP	Cal Date	Last Cal Date	Cal Due Date
g	0.0001	QC012	1/10/20	6/10/19	6/2020

FUNCTIONAL CHECKS

ECCENTRICITY		LINEARITY		STANDARD DEVIATION			ENVIRONMENTAL CONDITIONS
Test Wt:	Tol:	Test Wt:	Tol:	Test Wt:	Tol:		
100	0.0003	50 x 4	0.0002	100	0.0001		<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>
As-Found:		As-Found:		1. 100.0001	5. 99.9999	9. 100.0000	Good Fair Poor
Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	2. 100.0000	6. 100.0000	10. 99.9999	
As-Left:		As-Left:		3. 100.0000	7. 100.0001	Result	Temperature: 19.3°C
Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	Pass: <input checked="" type="checkbox"/>	Fail: <input type="checkbox"/>	4. 100.0000	8. 100.0000	0.00006	

A2LA ACCREDITED SECTION OF REPORT

Standard	As-Found	As-Left	Expanded Uncertainty
200	199.9997	200.0000	0.00019
100	100.0000	100.0001	0.00018
50	49.9999	50.0001	0.00018
20	20.0001	20.0000	0.00017
1	0.9998	0.9999	0.00017
0.1	0.0999	0.1000	0.00017

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	Rice Lake	20kg to 1mg	7133	4/19/19	4/2020	20190811

Permanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

01/20 RH= 49% Adjusted span.

Report prepared/reviewed by: R.B. Date: 1-10-20

Technician: R. Butcher

Signature: R. Butcher

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

PT ID: DIR101

Certificate of Calibration

Certificate Number: **712600**



JJ Calibrations, Inc.

7724 SE Aspen Summit Drive

Portland, OR 97266-9217

Phone 503.786.3005

FAX 503.786.2994

PFS TECO

11785 SE Hwy 212

Suite 305

Clackamas, OR 97015

PO: **john.steinst.PFSTECO.co**

Order Date: **11/06/2019**

Authorized By: **N/A**



Calibrated on: **11/15/2019**

*Recommended Due: **11/15/2020**

Environment: **21 °C 48 % RH**

* As Received: **Within Tolerance**

* As Returned: **Within Tolerance**

Action Taken: **Calibrated**

Technician: **146**

Property #: **064**

User: **N/A**

Department: **N/A**

Make: **Control Company**

Model: **4198**

Serial #: **80531676**

Description: **Digital Temp. / Barometer**

Procedure: **404323**

Accuracy: **±1°C ±0.2362Hg(±8mb)**

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
644A	Thunder Scientific	1200	Two Pressure Humidity Generator	10/14/2020	710583
847A	Fluke	RPM4	Reference Pressure Monitor	11/21/2019	688957

Parameter

Measurement Data

Measurement Description	Range Unit	Reference	Min	Max	^k Error	UUT	Uncertainty
Before/After Temperature	°C	20.00	19.0	21.0	0.1	20.1 °C	8.1E-02 ✓
	°C	30.00	29.0	31.0	0.8	29.2 °C	8.1E-02 ✓
	°C	40.00	39.0	41.0	0.2	39.8 °C	8.1E-02 ✓
Barometer	mbar	1010.70	1002.7	1018.7	0.7	1010.0 mbar	

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 ration (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 11/16/2019

Rev # 15

Inspector



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Report of Calibration

Firm: Dirigo Laboratories
Address: 11785 SE Hwy 212, Ste 305
City/State/Zip: Clackamas, OR 97015

Test Completed: 03/21/17
Submitted By: John Steiner
Traceable Number: 20170468

Test Item: 200mg and 100mg Individual Weights
Serial No.: Listed in Table

Manufacturer: Troemner

<u>Material</u>	<u>Assumed Density</u>	<u>Range</u>	<u>Tolerance Class</u>
Stainless Steel	7.95 g/cm ³	200mg & 100mg	ASTM Class 1

Method and Traceability

The procedure used for this calibration is NIST IR 6969 SOP 4 Double Substitution Weighing Design. Standards used for comparison are traceable to the National Institute of Standards and Technology (reports on file) and are part of a comprehensive measurement assurance program for ensuring continued accuracy and traceability within the level of uncertainty reported. The Traceable Number listed above is Traceable to National Standards through an unbroken chain of comparison each having stated uncertainties.

Standards Used:

100g to 1mg Working Standards Were Calibrated: 03/03/17 Due: 03/31/18 Standards ID: 723318
Mass Comparators Used: MET-05 Tested by: D. Thompson

Conventional Mass: “The conventional value of the result of weighing a body in air is equal to the mass of a standard, of conventionally chosen density, at a conventionally chosen temperature, which balances this body at this reference temperature in air of conventionally chosen density. International Recommendation 33 (OIML IR 33 1973, 1979). “Conventional Value of the Result of Weighing in Air” (Previously known as “Apparent Mass vs. 8.0g/cm³”).

Uncertainty Statement: The uncertainty conforms to the ISO Guide to the Expressions of Uncertainty in Measurement. Uncertainty as reported is based on a coverage factor k=2 for an approximate 95 percent level of uncertainty. Uncertainty components include the standard deviation of the process, the uncertainty of the standard used, an uncertainty component associated with the potential drift of the standard used, and the estimated uncertainty related to measuring and determining the air buoyancy effect.

Conventional Mass Values are listed on page 2 of this report.

page 1 of 2

Quality Control Services, Inc.
Metrology Laboratory Manager
E-mail dthompson@qc-services.com

Date: 03/21/17

Signature David S. Thompson

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Report of Calibration

Firm: Dirigo Laboratories
Address: 11785 SE Hwy 212, Ste 305
City/State/Zip: Clackamas, OR 97015

Test Completed: 03/21/17
Submitted By: John Steiner
Traceable Number: 20170468

Test Item: 200mg and 100mg Individual Weights
Serial No.: Listed in Table

Manufacturer: Troemner

Laboratory Environment at time of test

Temperature °C	Pressure mmHg	Humidity %RH
21.967	753.44	49.44

Conventional Mass Value

Nominal Value	As Found grams	As Found Correction* (mg)	Uncertainty (mg)	Tolerance (mg)
200mg SN 1000101395	0.2000061	0.0061	0.0026	0.01
100mg SN 1000126267	0.1000046	0.0046	0.0028	0.01

*Correction is the difference between the conventional mass value of a weight and its nominal value.

Comments: These weights were new from the manufacturer and were within ASTM Class 1 tolerances As Found. No adjustments or changes were made so As Found values should be considered to be As Left values.

Accredited by the American Association for Laboratory Accreditation (A2LA) under Calibration Laboratory Code 115953 and Certificate Number 1550.01. This laboratory meets the requirements of ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration.

page 2 of 2

Quality Control Services, Inc.
Metrology Laboratory Manager
E-mail dthompson@qc-services.com

Date: 03/21/17

Signature David S. Thompson



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Report of Calibration

Firm: Dirigo Laboratories
Address: 11785 SE Hwy 212, Ste 305
City/State/Zip: Clackamas, OR 97015

Test Completed: 01/15/16
Purchase Order: 1001
Traceable Number: 20152489

Test Item: 20lb and 10lb Individual Grip Handle Weights
Serial No.: Listed in Table

Manufacturer: Unknown

<u>Material</u>	<u>Assumed Density</u>	<u>Range</u>	<u>Tolerance Class</u>
Cast Iron	7.2 g/cm ³	20lb to 10lb	NIST HB 105-1 (F)

Method and Traceability

The procedure used for this calibration is NIST IR 6969 SOP 7 Single Substitution Weighing Design. Standards used for comparison are traceable to the National Institute of Standards and Technology (reports on file) and are part of a comprehensive measurement assurance program for ensuring continued accuracy and traceability within the level of uncertainty reported. The Traceable Number listed above is Traceable to National Standards through an unbroken chain of comparison each having stated uncertainties.

Standards Used:

Avoirdupois Working Standards were calibrated: 06/18/2014 Due: 06/18/2016 Standards ID: 34AA

Mass Comparators Used: MET-09, 20

Tested by: D. Thompson

Conventional Mass: "The conventional value of the result of weighing a body in air is equal to the mass of a standard, of conventionally chosen density, at a conventionally chosen temperature, which balances this body at this reference temperature in air of conventionally chosen density. International Recommendation 33 (OIML IR 33 1973, 1979). "Conventional Value of the Result of Weighing in Air" (Previously known as "Apparent Mass vs. 8.0g/cm³).

Uncertainty Statement: The uncertainty conforms to the ISO Guide to the Expressions of Uncertainty in Measurement. Uncertainty as reported is based on a coverage factor K=2 for an approximate 95 percent level of uncertainty. Uncertainty components include the standard deviation of the process, the uncertainty of the standard used, an uncertainty component associated with the potential drift of the standard used, and the estimated uncertainty related to measuring and determining the air buoyancy effect.

Conventional Mass Values are listed on page 2 of this report.

page 1 of 2

Quality Control Services, Inc.
Metrology Laboratory Manager
E-mail dthompson@qc-services.com

Date: 01/15/16


Signature David S. Thompson

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Report of Calibration

Firm: Dirigo Laboratories
Address: 11785 SE Hwy 212, Ste 305
City/State/Zip: Clackamas, OR 97015

Test Completed: 01/15/16
Purchase Order: 1001
Traceable Number: 20152489

Test Item: 20lb and 10lb Individual Grip Handle Weights
Serial No.: Listed in Table

Manufacturer: Unknown

Laboratory Environment at time of test

Temperature °C	Pressure mmHg	Humidity %RH
21.448	760.64	44.58

Conventional Mass Value

Nominal Value	As Found pounds	As Found Correction* (mg)	Uncertainty (mg)	Tolerance (mg)
20lb #098	19.9995450	-206.4	6.4	910
10lb #097	10.0006510	295.3	5.1	450
10lb #051	10.0003421	155.2	5.1	450

*Correction is the difference between the conventional mass value of a weight and its nominal value.


Comments: These weights were received in good condition and were within NIST Handbook 105-1 Class F tolerances As Found. No adjustments or changes were made so As Found values should be considered to be As Left values.

Accredited by the American Association for Laboratory Accreditation (A2LA) under Calibration Laboratory Code 115953 and Certificate Number 1550.01. This laboratory meets the requirements of ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration.

page 2 of 2

Quality Control Services, Inc.
Metrology Laboratory Manager
E-mail dthompson@qc-services.com

Date: 01/15/16


Signature David S. Thompson



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Report of Calibration

Firm: PFS Teco
Address: 11785 SE Hwy 212, Ste 305
City/State/Zip: Clackamas, OR 97015

Test Completed: 08/27/18
Submitted By: John Steinert
Traceable Number: 20181772

Test Item: 5 lb Individual Grip Handle Weight
Serial No.: 10744

Manufacturer: Rice Lake

<u>Material</u>	<u>Assumed Density</u>	<u>Range</u>	<u>Tolerance Class</u>
Cast Iron	7.2 g/cm ³	5 lb	ASTM Class 7

Method and Traceability

The procedure used for this calibration is NIST IR 6969 SOP 7 Single Substitution Weighing Design. Standards used for comparison are traceable to the National Institute of Standards and Technology (reports on file) and are part of a comprehensive measurement assurance program for ensuring continued accuracy and traceability within the level of uncertainty reported. The Traceable Number listed above is Traceable to National Standards through an unbroken chain of comparison each having stated uncertainties.

Standards Used:

20 kg to 200 g Working Standards Were Calibrated: 03/22/18 Due: 03/31/19 Standards ID: 75388
100 g to 1 mg Working Standards Were Calibrated: 04/04/18 Due: 04/30/19 Standards ID: 723318

Mass Comparators Used: MET-08

Tested by: D. Thompson

Conventional Mass: “The conventional value of the result of weighing a body in air is equal to the mass of a standard, of conventionally chosen density, at a conventionally chosen temperature, which balances this body at this reference temperature in air of conventionally chosen density. International Recommendation 33 (OIML IR 33 1973, 1979). “Conventional Value of the Result of Weighing in Air” (Previously known as “Apparent Mass vs. 8.0 g/cm³”).


Uncertainty Statement: The uncertainty conforms to the ISO Guide to the Expressions of Uncertainty in Measurement. Uncertainty as reported is based on a coverage factor k=2 for an approximate 95 percent level of uncertainty. Uncertainty components include the standard deviation of the process, the uncertainty of the standard used, an uncertainty component associated with the potential drift of the standard used, and the estimated uncertainty related to measuring and determining the air buoyancy effect.

Conventional Mass Values are listed on page 2 of this report.

page 1 of 2

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E-mail dthompson@qc-services.com

Date: 08/28/18


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Report of Calibration

Firm: PFS Teco
Address: 11785 SE Hwy 212, Ste 305
City/State/Zip: Clackamas, OR 97015

Test Completed: 08/27/18
Submitted By: John Steinert
Traceable Number: 20181772

Test Item: 5 lb Individual Grip Handle Weight
Serial No.: 10744

Manufacturer: Rice Lake

Laboratory Environment at time of test

Temperature °C	Pressure mmHg	Humidity %RH
21.838	762.06	52.23

Conventional Mass Value

Nominal Value	As Found pounds	As Found Correction* (mg)	Uncertainty (mg)	Tolerance (mg)
5 lb	5.0006085	276.0	2.0	760

*Correction is the difference between the conventional mass value of a weight and its nominal value.

Comments: This weight was new from the manufacturer and was within ASTM Class 7 tolerances As Found. No adjustments or changes were made so As Found values should be considered to be As Left values.

Accredited by the American Association for Laboratory Accreditation (A2LA) under Calibration Laboratory Code 115953 and Certificate Number 1550.01. This laboratory meets the requirements of ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration.

page 2 of 2

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Metrology Laboratory Manager
E-mail dthompson@qc-services.com

Date: 08/28/18

Signature David S. Thompson

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Tape Measure Calibration

Rule Equipment ID: 101

Date: 1/23/2020

Std. Gage Block ID: 146

Ambient (F): 70

Cal. Expiration Date: 1/7/2023

Technician: AK

Std. Surface Plate ID: 147

Cal. Expiration Date: 1/3/2023

System: Imperial Metric



Visual Inspection

Pass Fail

Full Length Operation Check

Pass Fail

Tape in Tension

Tolerance: 0.1

Standard	Measured
1.0	1.0
6.0	6.0

Within Tolerance

Tape in Compression

Tolerance: 0.1

Standard	Measured
1.0	1.0
6.0	6.0

Within Tolerance

Body Length

Tolerance: 0.1

Standard	Measured
3.0	3.0

Within Tolerance

Calibration Due

1/23/2021

Notes

Technician Signature

A handwritten signature in black ink on a light gray background.

Caliper Calibration

Caliper Equipment ID: 117

Date: 1/23/2020

Std. Gage Block ID: 146

Ambient (F): 70

Cal. Expiration Date: 1/10/2023

Technician: AK

Std. Surface Plate ID: 147

Cal. Expiration Date: 1/3/2023

System: Imperial Metric



Visual Inspection

Pass Fail

Outside Jaws

Tolerance: 0.002

Standard	Measured
0.050	0.050
0.250	0.250
1.000	1.000
2.000	2.001
6.000	5.999

Within Tolerance

Inside Jaws

Tolerance: 0.005

Standard	Measured
0.050	0.050
0.250	0.248
1.000	0.999
2.000	1.999
6.000	6.001

Within Tolerance

Depth

Tolerance: 0.005

Standard	Measured
0.050	0.056

Out of Tolerance

Calibration Due

1/17/2021

Notes

Depth gauge found out of tolerance and therefore removed

Calibration covers only inside & outside jaws

Technician Signature

A handwritten signature in black ink on a light gray background.

CERTIFICATE OF CALIBRATION

CUSTOMER:	PFS-TECO : CLACKAMAS, OR	CALIBRATION DATE:	03/14/2019
PO NUMBER:	N/A	CALIBRATION DUE:	03/14/2020
INST. MANUFACTURER:	DWYER	PROCEDURE:	T.O.33K6-4-1769-1
INST. DESCRIPTION:	VELOMETER	CALIBRATION FLUID:	AIR @ 14.7 PSIA 70°F
MODEL NUMBER:	471	RECEIVED CONDITION:	WITHIN MFG. SPECS.
SERIAL NUMBER:	CP288559 (ID# 095)	LEFT CONDITION:	WITHIN MFG. SPECS.
RATED UNCERTAINTY:	SEE NOTES BELOW.	AMBIENT CONDITIONS:	762 mm HGA 43% RH 69°F
UNCERTAINTY GIVEN:	± .20% RD ; k=2	CERTIFICATE FILE #:	490265.2019
NOTES:	± 3% FS (0-500 / 0-1500) *** ± 4% F.S. (0-5000) ***± 5% F.S. (0-15000) *** ± 2 °F		
NOTES CONT. :	Q.MANUAL IM 1.5 REV 2017.1 DATED 7-18-2017		

UUT INDICATED FT/MIN	DM.STD. ACTUAL FT/MIN	UUT INDICATED DEG. F	DM STD. ACTUAL DEG. F
64	65	0 TO 200°F	0 TO 200°F
110	112	43.4	43.5
206	210	69.0	68.9
498	509	99.4	99.2
503	505		
1049	1058		
1497	1514		
509	513		
3419	3460		
4992	5068		
5136	5235		
13928	14232		

STANDARDS USED:

A220: 12" WIND TUNNEL 0 - 8000 FPM CMC ± .203% RD TRACE# 1520423238	DUE	05/23/2019
A24: HART SCIENTIFIC TEMP. STANDARD ±.024 F TRACE# 1520423238	DUE	03/07/2020

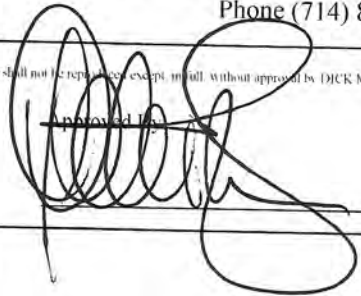
All instruments used in the performance of the shown calibration have traceability to the National Institute of Standards and Technology (NIST). The uncertainty ratio between the calibration standards (DM.STD.) used and the unit under test (UUT) is a minimum of 4:1, unless otherwise noted. Calibration has been performed per the shown procedure number, in accordance with ISO 10012:2003, ISO 17025:2005, ANSI/NC SL-Z-540.3, and/or MIL-STD-45662A. Test methods: API2530-92 & ASME MFC-3M-1989.

Dick Munns Company • 11133 Winners Circle • Los Alamitos, CA 90720
Phone (714) 827-1215 • Fax (714) 827-0823

This Calibration Certificate shall not be reproduced, except in full, without approval by DICK MUNNS COMPANY. The data shown applies only to the instrument being calibrated and under the stated conditions of calibration.

Date:

3/14/2019



Calibration Technician:

D.C.



Model 1430 Microtector® Electronic Point Gage

Installation and Operating Instructions



Model 1430 Microtector® Portable Electronic Point Gage combines modern, solid-state integrated circuit electronics with a time-proven point gage manometer to provide fast, accurate pressure measurements.

SPECIFICATIONS AND FEATURES

- Accurate and repeatable to $\pm .00025$ inches water column
- Pressure range: 0 - 2" w.c., positive, negative, or differential pressures
- Non-toxic and inexpensive gage fluid consists of distilled water mixed with a small amount of fluorescein green color concentrate
- Convenient, portable, lightweight and self-contained, the unit requires no external power connections and is operated by a 1.5 volt penlight cell
- A.C. detector current eliminates point plating, fouling and erosion
- Micrometers are manufactured in accordance with ASME B89.1.13-2001, and are traceable to a standard at the National Institute of Standards and Technology

- Three-point mounting, dual leveling adjustment, and circular level vial assure rapid setup
- Durablock® precision-machined acrylic gage body
- Sensitive 0 - 50 microamp D.C. meter acts as a detector and also indicates battery and probe condition
- Heavy 2" thick steel base plate provides steady mounting
- Top-quality glass epoxy circuit board and solid-state, integrated circuit electronics
- Electronic enclosure of tough, molded styrene acrylonitrile provides maximum protection to components yet allows easy access to battery compartment
- Rugged sheet steel cover and carrying case protects the entire unit when not in use
- Accessories included are (2) 3-foot lengths Tygon® tubing, (2) 1/8" pipe thread adapters and 3/4 oz. bottle of fluorescein green color concentrate with wetting agent

Maximum pressure: 100 psig with optional pipe thread connections.

Tygon® is a registered trademark of Saint-Gobain Corporation

DWYER INSTRUMENTS, INC.

P.O. BOX 373

MICHIGAN CITY, INDIANA 46361, U.S.A.

Phone: 219/879-8000

Fax: 219/872-9057

www.dwyer-inst.com

e-mail: info@dwyer-inst.com

J-2000

owner's manual



DELMHORST[®]
INSTRUMENT CO.

WHEN ACCURACY IS THE POINT.[™]



CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information

PXPKG TUALATIN OR H
10450 SW TUALATIN SHERWOOD ROAD
TUALATIN OR 97062

Certificate Modification Date: 10/01/2018
Praxair Order Number: 70743165
Part Number: NI CD17CO8E-AS

Fill Date: 09/26/2018
Lot Number: 70086826911
Cylinder Style & Outlet: AS CGA 590
Cylinder Pressure and Volume: 1290 psig 140 ft3

Certified Concentration

Expiration Date:	10/01/2026	NIST Traceable
Cylinder Number:	SA17187	Expanded Uncertainty
17.00 %	Carbon dioxide	± 0.3 %
4.31 %	Carbon monoxide	± 0.6 %
16.99 %	Oxygen	± 0.2 %
Balance	Nitrogen	

ProSpec EZ Cert



Certification Information:

Certification Date: 10/01/2018 Term: 96 Months Expiration Date: 10/01/2026

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1.

Do Not Use this Standard if Pressure is less than 100 PSIG.

CO2 responses have been corrected for Oxygen IR Broadening effect. O2 responses have been corrected for CO2 interference.

Analytical Data:

(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)

1. Component: Carbon dioxide
Requested Concentration: 17 %
Certified Concentration: 17.00 %
Instrument Used: Horiba VIA-510 S/N 20C194WK
Analytical Method: NDIR
Last Multipoint Calibration: 09/21/2018

First Analysis Data:		Date	
Z: 0	R: 20.1	C: 17	Conc: 17
R: 20.1	Z: 0	C: 17	Conc: 17
Z: 0	C: 17.01	R: 20.11	Conc: 17.01
UOM: %	Mean Test Assay:		17 %

Reference Standard: Type / Cylinder #: GMIS / CC187238
Concentration / Uncertainty: 20.10 % ±0.24%
Expiration Date: 06/07/2026
Traceable to: SRM # / Sample # / Cylinder #: RGM#CC193512 / NIA / RGM#CC193512
SRM Concentration / Uncertainty: 26.99% / ±0.05%
SRM Expiration Date: 05/15/2023

Second Analysis Data:		Date	
Z: 0	R: 0	C: 0	Conc: 0
R: 0	Z: 0	C: 0	Conc: 0
Z: 0	C: 0	R: 0	Conc: 0
UOM: %	Mean Test Assay:		%

2. Component: Carbon monoxide
Requested Concentration: 4.25 %
Certified Concentration: 4.31 %
Instrument Used: Horiba VIA-510 S/N UB9UCSYX
Analytical Method: NDIR
Last Multipoint Calibration: 09/21/2018

First Analysis Data:		Date	
Z: 0	R: 5	C: 4.31	Conc: 4.31
R: 5	Z: 0	C: 4.3	Conc: 4.3
Z: 0	C: 4.32	R: 5.01	Conc: 4.32
UOM: %	Mean Test Assay:		4.31 %

Reference Standard: Type / Cylinder #: GMIS / CC242633
Concentration / Uncertainty: 5.00 % ±0.543%
Expiration Date: 04/03/2025
Traceable to: SRM # / Sample # / Cylinder #: SRM 2642a / 51-D-23 / FF23106
SRM Concentration / Uncertainty: 7.859% / ±0.039%
SRM Expiration Date: 07/15/2019

Second Analysis Data:		Date	
Z: 0	R: 0	C: 0	Conc: 0
R: 0	Z: 0	C: 0	Conc: 0
Z: 0	C: 0	R: 0	Conc: 0
UOM: %	Mean Test Assay:		%

3. Component: Oxygen
Requested Concentration: 17 %
Certified Concentration: 16.99 %
Instrument Used: OXYMAT 5E
Analytical Method: Paramagnetic
Last Multipoint Calibration: 09/04/2018

First Analysis Data:		Date	
Z: 0	R: 20.86	C: 16.99	Conc: 16.99
R: 20.86	Z: 0	C: 16.99	Conc: 16.99
Z: 0	C: 16.99	R: 20.86	Conc: 16.99
UOM: %	Mean Test Assay:		16.99 %

Reference Standard: Type / Cylinder #: GMIS / CC75874
Concentration / Uncertainty: 20.86 % ±0.111%
Expiration Date: 11/07/2025
Traceable to: SRM # / Sample # / Cylinder #: SRM 2559a / 71-E-19 / FF22331
SRM Concentration / Uncertainty: 20.863% / ±0.021%
SRM Expiration Date: 08/23/2021

Second Analysis Data:		Date	
Z: 0	R: 0	C: 0	Conc: 0
R: 0	Z: 0	C: 0	Conc: 0
Z: 0	C: 0	R: 0	Conc: 0
UOM: %	Mean Test Assay:		%

Analyzed By

Jose Vasquez

Certified By

Danielle Burns



CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information

PXPKG TUALATIN OR H
10450 SW TUALATIN SHERWOOD ROAD
TUALATIN OR 97062

Certificate Modification Date: 09/05/2018
Praxair Order Number: 70716136
Part Number: NI CD10CO33E-AS

Fill Date: 08/31/2018
Lot Number: 70086824308
Cylinder Style & Outlet: AS CGA 590
Cylinder Pressure and Volume: 2000 psig 140 ft3

Certified Concentration

Expiration Date:	09/05/2026	NIST Traceable
Cylinder Number:	CC170624	Expanded Uncertainty
10.00 %	Carbon dioxide	± 0.3 %
2.51 %	Carbon monoxide	± 0.7 %
10.50 %	Oxygen	± 0.6 %
Balance	Nitrogen	

ProSpec EZ Cert



Certification Information:

Certification Date: 09/05/2018 Term: 96 Months Expiration Date: 09/05/2026

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1.

Do Not Use this Standard if Pressure is less than 100 PSIG.

CO responses have been corrected for CO2 interference. CO2 responses have been corrected for Oxygen IR Broadening effect. O2 responses have been corrected for CO2 interference

Analytical Data:

(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)

1. Component:

Carbon dioxide

Requested Concentration: 10 %
Certified Concentration: 10.00 %
Instrument Used: Horiba VIA-510 S/N 20C194WK
Analytical Method: NDIR
Last Multipoint Calibration: 08/20/2018

Reference Standard: Type / Cylinder #: GMIS / CC141375
Concentration / Uncertainty: 14.02 % ± 0.3%
Expiration Date: 06/11/2026

Traceable to: SRM # / Sample # / Cylinder #: SRM 1675b / 6-F-51 / CAL014538
SRM Concentration / Uncertainty: 13.963% / ± 0.034%
SRM Expiration Date: 05/16/2022

First Analysis Data:				Date			
Z:	0	R:	14.02	C:	10	Conc:	10
R:	14.02	Z:	0	C:	10	Conc:	10
Z:	0	C:	10	R:	14.02	Conc:	10
UOM:	%	Mean Test Assay:		10	%		

Second Analysis Data:				Date			
Z:	0	R:	0	C:	0	Conc:	0
R:	0	Z:	0	C:	0	Conc:	0
Z:	0	C:	0	R:	0	Conc:	0
UOM:	%	Mean Test Assay:			%		

2. Component:

Carbon monoxide

Requested Concentration: 2.5 %
Certified Concentration: 2.51 %
Instrument Used: Horiba VIA-510 S/N UB9UCSYX
Analytical Method: NDIR
Last Multipoint Calibration: 08/20/2018

Reference Standard: Type / Cylinder #: GMIS / CC102045
Concentration / Uncertainty: 2.48 % ± 0.448%
Expiration Date: 04/03/2025

Traceable to: SRM # / Sample # / Cylinder #: SRM 2641a / 52-D-30 / CAL017193
SRM Concentration / Uncertainty: 4.009% / ± 0.017%
SRM Expiration Date: 07/15/2019

First Analysis Data:				Date			
Z:	0	R:	2.48	C:	2.51	Conc:	2.51
R:	2.48	Z:	0	C:	2.51	Conc:	2.51
Z:	0	C:	2.51	R:	2.48	Conc:	2.51
UOM:	%	Mean Test Assay:		2.51	%		

Second Analysis Data:				Date			
Z:	0	R:	0	C:	0	Conc:	0
R:	0	Z:	0	C:	0	Conc:	0
Z:	0	C:	0	R:	0	Conc:	0
UOM:	%	Mean Test Assay:			%		

3. Component:

Oxygen

Requested Concentration: 10.5 %
Certified Concentration: 10.50 %
Instrument Used: OXYMAT 5E
Analytical Method: Paramagnetic
Last Multipoint Calibration: 09/04/2018

Reference Standard: Type / Cylinder #: NTRM / DT0010402
Concentration / Uncertainty: 9.88 % ± 0.4%
Expiration Date: 11/18/2022

Traceable to: SRM # / Sample # / Cylinder #: NTRM #170701 / N/A / NTRM #DT0010402
SRM Concentration / Uncertainty: 9.875% / ± 0.040%
SRM Expiration Date: 11/18/2022

First Analysis Data:				Date			
Z:	0	R:	9.88	C:	10.49	Conc:	10.49
R:	9.88	Z:	0	C:	10.5	Conc:	10.5
Z:	0	C:	10.5	R:	9.88	Conc:	10.5
UOM:	%	Mean Test Assay:		10.5	%		

Second Analysis Data:				Date			
Z:	0	R:	0	C:	0	Conc:	0
R:	0	Z:	0	C:	0	Conc:	0
Z:	0	C:	0	R:	0	Conc:	0
UOM:	%	Mean Test Assay:			%		

Analyzed By

Danielle Burns

Certified By

Jose Vasquez