OMNI-Test Laboratories, Inc.

EPA Standard of Performance for New Residential Wood Heaters

Certification Test Report

Non-Confidential Business Information (Non-CBI)

Manufacturer: Hearth & Home Technologies, Inc.
Heater Type: Wood-Fired, Freestanding
Model: Defiant 1975-CAT-C

Prepared for:
Hearth & Home Technologies, Inc.
352 Mountain House Road
Halifax, PA 17032
USA

Prepared by:
OMNI-Test Laboratories, Inc.
13327 NE Airport Way
Portland, OR 97230
(503) 643-3788

Test Period: April 19 – April 26, 2019

Report Date: June 14, 2019
Report Revision Date: July 23, 2024

Report Number: 0135WS043E

Authorized Signatories

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

Evaluator:

Ken Morgan
Technical Services Director
OMNI-Test Laboratories, Inc.

Table of Contents

Section 1
Summary Tables

1.1 - Summary Tables

1.1 - Summary Tables

Table 1 – Particulate Emissions

Run	Burn Rate	ASTM E2515 Emissions [1]Uncorrected	ASTM E2515 Emissions [2]Corrected
	(kg/hr dry)	(g/hr)	(g/hr)
1	0.81	0.63	0.63
2	1.78	2.69	2.73
3	0.98	0.80	0.81
4	0.94	0.65	0.65
5	1.24	*1.23	1.23
6	*1.26*	*1.06*	1.06
Weighted Average:		**1.32**	

*Run 5 is a fan confirmation and not included in the weighted average.

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

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

Table 2 – First Hour Emissions

Run	E2515 Emissions - 1st Hour [1]Uncorrected (g/hr)	E2515 Emissions - 1st Hour [2]Corrected (g/hr)
1	0.94	0.94
2	3.17	3.17
3	1.02	1.02
4	0.83	0.83
6	2.53	1.06

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

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

Table 3 – Test Facility Conditions

Run	Room Temperature (˚F)		Barometric Pressure ("Hg)		Air Velocity (ft/min)	
	Before	After	Before	After	Before	After
1	73	68	30.04	30.01	<50	<50
2	73	73	30.34	30.30	<50	<50
3	72	72	30.24	30.23	<50	<50
4	71	73	30.38	30.24	<50	<50
6	73	75	30.28	30.19	<50	<50

Table 4- Efficiency & CO

Run	Heat Output	HHV Efficiency	LHV Efficiency	CO Emissions		
	(BTU/hr)	(%)	(%)	(g/MJ Output)	(g/kg Dry Fuel)	(g/min)
1	11,974	79.0%	85.4%	5.30	82.92	1.11
2	25,471	76.8%	83.0%	5.53	84.13	2.48
3	14,429	78.8%	85.2%	4.56	71.25	1.16
4	13,983	79.8%	86.2%	3.54	55.95	0.87
6	18,214	77.0%	83.2%	5.28	80.46	1.69
Weighted Average:		**77.9%**		Arithmetic Average (g/min):		**1.46**

Table 5 – Heater Configuration

	Air Settings	Photograph (if Applicable)
Category I	Primary @ min. (Fixed stop) Fan at min. fixed stop	N/A
Category II	~10° From vertical Fan at min. fixed stop	
Category III	~21° From vertical Fan at max fixed stop	
Category IV	Primary @ max. (Fixed Stop) Fan at max fixed stop	N/A

Section 2 - Performance Testing

2.1 – Procedures, Narrative, and Results Summary

TESTING PROCEDURE

The Defiant 1975-CAT-C was tested in accordance with the U.S. EPA 40 CFR Part 60, Subpart AAA – Standards of Performance for New Residential Wood Heaters using ASTM E2515 and ASTM E2780. The fuel used for certification testing was premium Douglas Fir 4x4 nominal lumber. Fueling protocols were in conjustion with EPA Method 28 and 28R. Two parallel sample trains were used per ASTM E2515, each with a front & rear filter.

For all runs, the 5-minute startup procedures were the same. The primary air control was set at the start of the test run and not manipulated. At the start of the test run, the bypass and doors were opened. The test fuel was then loaded as quickly as possible, photographed, and the doors and bypass closed again. This was accomplished in under 90 seconds for all test runs.

RUN NARRATIVE

Run 1 - Attempted category 1 burn rate with a primary air setting of full closed. Observed burn rate of 0.81 kg/h (category 2). Background filter sampling was not collected during this run; therefore, the total particulate catch was not adjusted. No additional sampling anomalies occurred, this test run is valid and appropriate for inclusion in the weighted average.

Run 2 - Attempted category 4 burn rate at primary air setting of full open. Observed burn rate of 1.78 kg/h (category 3). Negative filter weight was found on Train A (remainder). This is caused by filter material transferring to the O-ring gasket. Transfer weight can be seen as a positive weight on the O-rings, negative filter is added back into the calculation to prevent transfer weight as being counted as emissions. Background filter sampling was not collected during this run; therefore, the total particulate catch was not adjusted. No additional sampling anomalies occurred, this test run is valid and appropriate for inclusion in the weighted average.

Run 3 - Attempted category 2 burn rate at primary air setting of ~10° from vertical. Observed burn rate of 0.98 kg/h (category 2). Negative filter weight was found on Train B. This is caused by filter material transferring to the O-ring gasket. Transfer weight can be seen as a positive weight on the O-rings, negative filter is added back into the calculation to prevent transfer weight as being counted as emissions. Background filter sampling was not collected during this run; therefore, the total particulate catch was not adjusted. No additional sampling anomalies occurred, this test run is valid and appropriate for inclusion in the weighted average.

Run 4 - Attempted category 3 burn rate at primary air setting of ~13° from vertical. Observed burn rate of 0.94 kg/h (category 2). This test run valid for inclusion in the weighted average. Background filter sampling was not collected during this run; therefore, the total particulate catch was not adjusted. No additional sampling anomalies occurred, this test run is valid and appropriate for inclusion in the weighted average.

Run 5 – Fan confirmation test, not included in the weighted average. Attempted category 2 burn rate at primary air setting of ~15° from vertical. Observed burn rate of 1.24 kg/h (category 2). Background filter sampling was not collected during this run; therefore, the total particulate catch was not adjusted. No additional sampling anomalies occurred, this test run valid and appropriate for use in comparison of operation with and without the blower.

Run 6 – Attempted category 3 burn rate at primary air setting of ~21° from vertical. Observed burn rate of 1.26 kg/h (category 3). Background filter sampling was not collected during this run; therefore, the total particulate catch was not adjusted. No additional sampling anomalies occurred, this test run is valid and appropriate for inclusion in the weighted average.

RESULTS SUMMARY

The results of the integrated test run indicate an average particulate emission rate of 1.32 g/hr. The Defiant 1975-CAT-C results are within the emission limit of 2.0 g/hr for affected appliances manufactured or sold on or after May 15, 2020.

The model Defiant 1975-CAT-C was tested for thermal efficiency and carbon monoxide (CO) emissions in accordance with CSA B415.1-10. The heater has a demonstrated an average thermal efficiency of 77.9%. The calculated CO emission rate was 1.46 g/min.

Upon completion of emissions certification testing, the sample unit was sealed and will be stored by the manufacturer in accordance with the requirements of the CFR.

2.2 - Appliance Description

Appliance Manufacturer: Hearth & Home Technologies, Inc.

Wood Stove Model: Defiant 1975-CAT-C

Materials of Construction: The unit is constructed primarily of cast iron. The firebox is lined with refractory brick. The feed doors feature fiberglass rope gasketing to retain 5mm ceramic glass panels.

Air Introduction System: Primary air is controlled by a Bi-metallic spring thermostat located at the right rear of the stove top. Moving the control arm fully to the left opens the air control, fully to the right closes the air. As the spring heats up, it tightens causing the controlling damper to close. Secondary air is un-controlled, it enters the appliance through an opening located at the rear of the stove on the bottom side. Air travels into the refractory secondary combustion system and enters the flame path through orifices in the refractory walls.

Combustion Control Mechanisms: Primary air is controlled by a Bi-metallic spring thermostat located at the right rear of the stove top. Moving the control arm fully to the left opens the air control, fully to the right closes the air. As the coil spring heats up, it tightens causing the controlling damper to close, cooling of the spring loosens the coil and allows the controlling damper to open. Position of the control arm sets the tension of the coil that determines how much heat is needed to cause the control damper to close.

Combustor: A rectangular, ceramic-substrate combustor is located within the refractory assembly and all combustion products are directed through it when the bypass is closed

Internal Baffles: An internal baffle is not used; flame path is either directed through a bypass opening or through the refractory combustion chamber.

Other Features: A bypass is operated by a handle located on the left side of the firebox. The ash pan is accessed through a door located under the front fuel loading door, a top fuel loading door is in the stove top. Appliance comes with a temperature sensor that is within 2.54cm (1 inch) of the combustor catalyst.

Flue Outlet: The 8” oval flue outlet is located in the top rear of the unit. The appliance is also offered with an 8” oval to 6” round adaptor for use with 6” venting systems.

Wood Heater Operating Instructions: Specific Written Instructions: See Appendix F of this report. All markings and instruction materials were reviewed for content prior to printing.

2.3 – Appliance & Fuel Photographs

Model: Defiant 1975-CAT-C

Defiant 1975-CAT-C Front

Defiant 1975-CAT-C Back

Defiant 1975-CAT-C Left

Defiant 1975-CAT-C Right

Defiant 1975-CAT-C Sealed Test Unit

Hearth and Home Technologies
Defiant 1975-CAT-C

Run 1 – Fuel Load

Run 1 – Fuel Loaded in Stove

Run 2 – Fuel Load

Run 2– Fuel Loaded in Stove

Hearth and Home Technologies
Defiant 1975-CAT-C

Run 3 – Fuel Load

Run 3 – Fuel Loaded in Stove

Run 4 – Fuel Load

Run 4 – Fuel Loaded in Stove

Hearth and Home Technologies
Defiant 1975-CAT-C

Run 5 – Fuel Load

Run 5 – Fuel Loaded in Stove

Run 6 – Fuel Load

Run 6 – Fuel Loaded in Stove

Section 3
Laboratory Quality Assurance

3.1 - Quality Assurance/Quality Control

3.1 - Quality Assurance/Quality Control

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

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

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

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

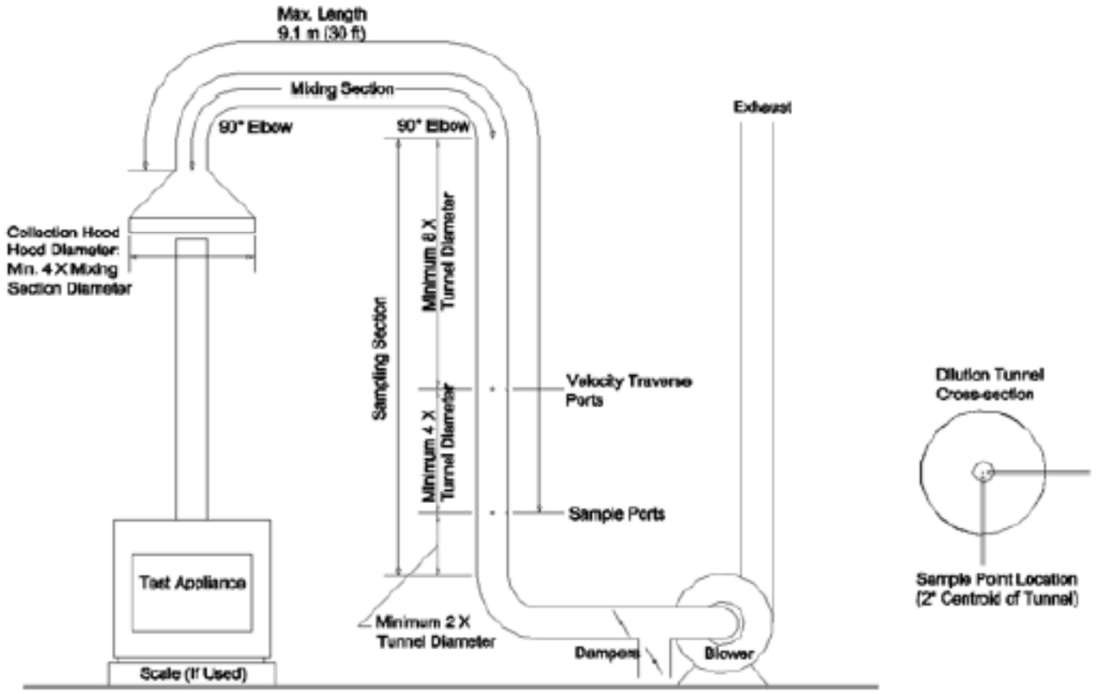
The manufacturing facilities and quality control system for the production of the Defiant 1975-CAT-C at Hearth & Home Technologies, Inc. were evaluated to determine if sufficient to maintain conformance with OMNI's requirements for product certification. OMNI has concluded that the manufacturing facilities, processes, and quality control system are adequate to produce the appliance congruous with the standards and model codes to which it was evaluated.

Appendix A – Test Data by Run

Includes:

Dilution Tunnel Schematic
Run 1
Run 2
Run 3
Run 4
Run 5 (fan confirmation)
Run 6

Example of ASTM E2515-11 Dilution Tunnel

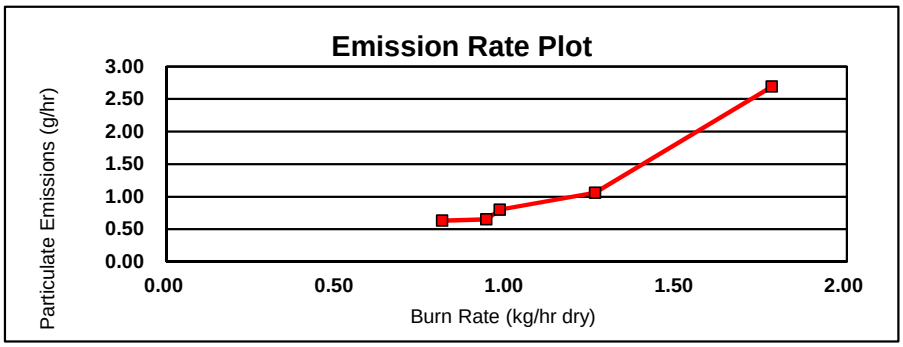


Prior to testing, sample point and travers point locations are verified to ensure placement is within specifications. Collection hood, tunnel diameter, and mixing section length are also verified to be within specifications.

EPA Weighted Average Emissions

Client:	Hearth & Home Techr	Status:	Final
Stove Model:	Defiant 1975-CAT-C	Stove Type:	Catalytic Stove
Test Dates:	April 19, 2019 - April 26, 2019		
Project Number:	0135WS043E		
Tracking Number:	2366		

Weighted Averages	**Emissions (g/hr):**	**1.3**
	HHV Efficeincy (%):	**77.9**
	LHV Efficeincy (%):	**84.1**



Run #	1			Run #	2	
Burn Rate (dry kg/hr)	0.81			Burn Rate (dry kg/hr)	1.78	
Category	2			Category	3	
LHV Efficiency (%)	85.4			LHV Efficiency (%)	83	
HHV Efficiency (%)	79			HHV Efficiency (%)	76.8	
Emissions (g/hr)	0.63			Emissions (g/hr)	2.69	
Weighting Factor	0.322	19.65%		Weighting Factor	0.418	25.50%

Run #	4	
Burn Rate (dry kg/hr)	0.94	
Category	2	
LHV Efficiency (%)	86.2	
HHV Efficiency (%)	79.8	
Emissions (g/hr)	0.65	
Weighting Factor	0.132	8.07%

Run #	3	
Burn Rate (dry kg/hr)	0.98	
Category	2	
LHV Efficiency (%)	85.2	
HHV Efficiency (%)	78.8	
Emissions (g/hr)	0.8	
Weighting Factor	0.259	15.80%

Run #	6	
Burn Rate (dry kg/hr)	1.26	
Category	3	
LHV Efficiency (%)	83.2	
HHV Efficiency (%)	77	
Emissions (g/hr)	1.06	
Weighting Factor	0.509	30.99%

Run 1

Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: Hearth & Home
Model: Defiant
Project No.: 0135WS043E
Tracking No.: 2366
Run: 1
Test Date: 04/19/19

Burn Rate	**0.81 kg/hr dry**
Average Tunnel Temperature	82 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	13.37 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	9054.1 dscf/hour
Average Delta p	0.047 inches H20
Total Time of Test	595 minutes

	AMBIENT	SAMPLE TRAIN 1	SAMPLE TRAIN 2	FIRST HOUR FILTER (TRAIN 1)
Total Sample Volume - Vm	0.000 cubic feet	96.123 cubic feet	96.087 cubic feet	9.632 cubic feet
Average Gas Meter Temperature	71 degrees Fahrenheit	82 degrees Fahrenheit	83 degrees Fahrenheit	82 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	0.000 dscf	96.327 dscf	93.516 dscf	9.643 dscf
Total Particulates - m_n	0 mg	6.9 mg	6.4 mg	1 mg
Particulate Concentration (dry-standard) - C_f/C_s	0.000000 grams/dscf	0.00007 grams/dscf	0.00007 grams/dscf	0.00010 grams/dscf
Total Particulate Emissions - E_T	0.00 grams	6.43 grams	6.14 grams	0.94 grams
Particulate Emission Rate	0.00 grams/hour	0.65 grams/hour	0.62 grams/hour	0.94 grams/hour
Emissions Factor		0.80 g/kg	0.76 g/kg	0.60 g/kg
Difference from Average Total Particulate Emissions		0.14 grams	0.14 grams	

Dual Train Comparison Results Are Acceptable

FINAL AVERAGE RESULTS

Complete Test Run	
Total Particulate Emissions - E_T	6.29 grams
Particulate Emission Rate	**0.63 grams/hour**
Emissions Factor	0.78 grams/kg
First Hour Emissions	
Total Particulate Emissions - E_T	0.94 grams
Particulate Emission Rate	0.94 grams/hour
Emissions Factor	0.60 grams/kg

QUALITY CHECKS

Filter Temps < 90 °F	OK
Filter Face Velocity (47 mm)	OK
Dryer Exit Temp < 80F	OK
Leakage Rate	OK
Ambient Temp (55-90°F)	OK
Negative Probe Weight Eval.	OK
Pro-Rate Variation	OK
Stove Surface ΔT	OK
Train Precision 7.5%	2.28
Train Precision 0.5g/kg	0.04

Technician Signature: 

Wood Heater Preburn Data - ASTM E2780

Run:	**1**
Manufacturer:	Hearth & Home
Model:	Defiant 1975-CAT-C
Tracking No.:	2366
Project No.:	0135WS043E
Test Date:	43574
Beginning Clock Time:	10:46

Coal Bed Range (lb):	**4.3** (min)	**5.3** (max)

Technician Signature: 

			Temperatures (°F)							
Elapsed Time (min)	Scale (lb)	Stack Draft (in H_2O)	FB Top	FB Bottom	FB Back	FB Left	FB Right	Avg. Firebox Surface	Stack	Ambient
0	10	-0.062	609	365	227	383	330	382.8	387	74
5	9.1	-0.052	562	358	219	391	350	376	245	73
10	8.4	-0.05	495	349	223	380	348	359	237	74
15	7.9	-0.05	443	343	239	365	338	345.6	235	74
20	7.3	-0.048	411	338	256	351	326	336.4	235	73
25	6.8	-0.052	392	338	269	340	317	331.2	289	74
30	6.2	-0.05	374	333	281	331	309	325.6	244	73
35	5.9	-0.046	364	327	290	323	301	321	226	73
40	5.7	-0.042	353	324	293	316	293	315.8	214	73
45	5.5	-0.04	345	322	291	311	286	311	204	73
50	5.2	-0.044	355	321	285	308	281	310	264	73
55	4.9	-0.043	344	315	285	307	281	306.4	217	73
60	4.7	-0.041	340	308	288	303	280	303.8	211	72
65	4.5	-0.039	336	303	289	299	278	301	204	73

Wood Heater Test Fuel Data - ASTM E2780

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 4/19/2019
Run No.: 1

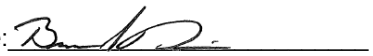
Firebox Volume (ft^3):	3.25
Fuel Piece Length (in):	20
2x4 Crib Weight (lb):	
4x4 Crib Weight (lb):	21.3

Total Fuel Weight (Dry Basis, lb):	17.7	
Fuel Density (lb/ft^3, Dry Basis):	28.88	OK
Loading Density (lb/ft^3, Wet Basis):	6.55	OK
2x4 Percentage:	N/A	N/A

Coal Bed Range (20-25%): **4.26 - 5.325**

Test Fuel Piece	Weight (lb)	Size	Readings (Dry Basis %)			Dry Weight (lb)
1	4.7	4"x 4"	21.9	22.4	20.5	3.87
2	5.3	4"x 4"	22.3	18.7	24.1	4.35
3	4.5	4"x 4"	19.5	18.5	19.3	3.78
4	5.3	4"x 4"	22.5	18.7	22.0	4.38

Spacer Readings (Dry Basis %)			
10.8	10.2		
9.6	10.7		
10.1	10.0		
10.2			
9.4			
10.2			
11.0			
10.5			
10.2			
9.5			
10.0			
10.4			
9.3			

Technician Signature: 

Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer: Hearth & Home
Model: Defiant
Tracking No.: 2366
Project No.: 0135WS043E
Run #: 1
Date: 4/19/19

Equipment Numbers: 283A, 637, 592

TRAIN 1 (First Hour emissions)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	D725	123.1	122.1	1.0
C. Rear filter catch	Filter				0.0
D. Probe catch*	Probe				0.0
E. Filter seals catch*	Seals				0.0

Sub-Total Total Particulate, mg: 1.0

TRAIN 1 (Post First Hour Change-out)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	D726	125.0	121.6	3.4
C. Rear filter catch	Filter	D727	120.9	120.6	0.3
D. Probe catch*	Probe	38	114151.8	114151.0	0.8
E. Filter seals catch*	Seals	R763	3356.9	3355.5	1.4

Sub-Total Total Particulate, mg: 5.9

Train 1 Aggregate Total Particulate, mg: **6.9**

TRAIN 2

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	D728	124.2	120.2	4.0
B. Rear filter catch	Filter	D729	121.7	121.2	0.5
C. Probe catch*	Probe	53	118273.8	118273.3	0.5
D. Filter seals catch*	Seals	R764	4114.3	4112.9	1.4

Total Particulate, mg: **6.4**

AMBIENT

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

Total Particulate, mg: **0.0**

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

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

Technician Signature: 

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - ASTM E2780 / ASTM E2515

Run: 1

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 19-Apr-19
Beginning Clock Time: 11:54

Total Sampling Time: 595 min
Recording Interval: 5 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.022 (1) 0.995 (2) _____ (Amb)

Barometric Pressure:

Begin	Middle	End	Average
30.04	30.03	30.01	30.03 "Hg

OMNI Equipment Numbers: _____

PM Control Modules: 335, 336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.190 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 13.37 ft/sec.
Initial Tunnel Flow: 146.4 scfm
Average Tunnel Flow: 150.9 scfm
Post-Test Leak Check (1): 0.000 cfm @ 5 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 5 in. Hg
Average Test Piece Fuel Moisture: 20.87 Dry Basis %

Technician Signature: _____

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.042	0.044	0.040	0.030	0.036	0.038	0.040	0.034	0.046	"H2O
Temp:	88	87	88	88	88	88	88	88	88	°F

V_{strav} 13.26 ft/sec V_{scent} 14.46 ft/sec F_p 0.918

	Particulate Sampling Data															Fuel Weight (lb)		Temperature Data (°F)														Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	vsi	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface Temp	Catalyst Exit Temp	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
0	0.000	0.000			1.12	76	1.66	0.86	78	1.6	103	0.043	13.00			21.3		349	300	289	298	279	303	1026	229	75	76	76	76	73	-0.036	8.28	0.22
5	0.794	0.800	0.16	0.16	1.35	76	1.82	1.06	78	1.6	91	0.045	13.16	103	103	21.0	-0.3	302	295	288	290	272	289	1123	217	76	75	77	77	73	-0.043	9.72	1.11
10	1.597	1.598	0.16	0.16	1.34	77	1.81	1.05	78	1.6	87	0.045	13.11	103	103	20.7	-0.3	270	290	293	274	261	278	1124	221	76	76	76	77	73	-0.044	9.74	0.93
15	2.398	2.394	0.16	0.16	1.33	77	1.8	1.05	79	1.6	88	0.044	12.98	104	103	20.4	-0.3	255	285	297	260	250	269	1123	217	75	77	76	77	72	-0.044	10	0.55
20	3.199	3.191	0.16	0.16	1.33	78	1.8	1.04	79	1.6	88	0.043	12.83	105	105	20.1	-0.3	245	280	300	248	242	263	1134	222	75	77	75	78	73	-0.044	10.13	0.52
25	4.001	3.988	0.16	0.16	1.33	79	1.8	1.04	80	1.6	87	0.046	13.26	102	101	19.8	-0.3	234	276	304	240	236	258	1170	226	75	78	75	78	71	-0.046	10.47	0.66
30	4.805	4.785	0.16	0.16	1.33	79	1.8	1.04	81	1.6	88	0.043	12.83	106	104	19.5	-0.3	235	272	308	233	231	256	1176	225	75	78	75	77	71	-0.044	10.33	0.74
35	5.608	5.582	0.16	0.16	1.33	80	1.8	1.04	81	1.6	88	0.043	12.83	105	104	19.1	-0.4	233	269	311	227	229	254	1191	224	75	77	75	71	71	-0.046	10.4	0.77
40	6.412	6.380	0.16	0.16	1.33	80	1.8	1.04	82	1.6	88	0.044	12.98	104	103	18.7	-0.4	235	265	315	223	227	253	1219	232	74	77	74	70	72	-0.046	10.8	0.67
45	7.216	7.179	0.16	0.16	1.33	81	1.81	1.04	82	1.6	89	0.044	12.99	104	103	18.3	-0.4	231	262	320	221	227	252	1257	235	75	77	75	71	72	-0.047	11.34	0.88
50	8.020	7.976	0.16	0.16	1.34	81	1.81	1.04	82	1.6	89	0.042	12.69	106	106	17.9	-0.4	240	260	326	219	228	255	1245	239	75	78	75	71	71	-0.048	10.81	0.69
55	8.826	8.775	0.16	0.16	1.34	81	1.81	1.04	83	1.6	89	0.043	12.84	105	104	17.5	-0.4	243	258	328	218	229	255	1223	232	75	78	75	72	71	-0.047	10.51	0.92
60	9.632	9.574	0.16	0.16	1.33	82	1.81	1.04	83	1.6	89	0.045	13.13	103	102	17.1	-0.4	243	256	327	218	230	255	1215	232	75	78	74	72	71	-0.047	10.55	1.01
65	10.439	10.374	0.16	0.16	1.33	82	1.82	1.04	83	1.6	89	0.043	12.84	105	105	16.7	-0.4	242	254	326	217	232	254	1232	233	76	78	74	72	71	-0.047	10.9	1.15
70	11.243	11.173	0.16	0.16	1.33	82	1.83	1.04	83	1.6	90	0.043	12.85	105	104	16.3	-0.4	246	252	326	217	235	255	1241	234	76	78	74	72	71	-0.049	11.07	1.15
75	12.048	11.973	0.16	0.16	1.32	82	1.82	1.04	83	1.6	90	0.042	12.70	106	106	15.9	-0.4	255	250	327	218	237	257	1239	234	75	78	74	73	72	-0.049	11.09	1.07
80	12.852	12.772	0.16	0.16	1.32	82	1.82	1.04	84	1.6	89	0.043	12.84	105	104	15.4	-0.5	260	248	327	219	240	259	1241	233	75	78	74	73	71	-0.049	11.15	1.06
85	13.656	13.572	0.16	0.16	1.33	83	1.82	1.04	84	1.6	89	0.044	12.99	104	103	15.0	-0.4	260	247	328	219	243	259	1263	238	75	78	74	73	72	-0.049	11.34	0.83
90	14.462	14.372	0.16	0.16	1.33	83	1.82	1.04	84	1.6	90	0.043	12.85	105	104	14.7	-0.3	258	246	330	219	246	260	1267	232	75	78	74	74	71	-0.049	11.54	0.91
95	15.267	15.171	0.16	0.16	1.33	83	1.83	1.04	84	1.6	90	0.043	12.85	105	104	14.2	-0.5	266	245	332	220	248	262	1276	242	75	78	75	74	71	-0.048	11.88	1.29
100	16.072	15.971	0.16	0.16	1.33	83	1.82	1.04	84	1.6	90	0.044	13.00	104	103	13.8	-0.4	279	244	335	222	252	266	1280	240	75	78	75	75	72	-0.050	11.88	1.52
105	16.878	16.771	0.16	0.16	1.33	83	1.83	1.04	84	1.6	90	0.044	13.00	104	103	13.3	-0.5	284	243	338	224	255	269	1277	240	75	79	75	75	72	-0.049	11.6	1.43
110	17.683	17.570	0.16	0.16	1.33	83	1.82	1.04	84	1.6	89	0.043	12.84	105	104	12.9	-0.4	289	241	338	227	258	271	1248	235	75	79	75	75	72	-0.047	11.38	1.19
115	18.489	18.370	0.16	0.16	1.32	83	1.82	1.04	84	1.6	89	0.042	12.69	106	106	12.5	-0.4	295	241	335	229	262	272	1227	233	75	78	75	75	73	-0.047	11.41	1.2
120	19.294	19.170	0.16	0.16	1.32	83	1.82	1.04	84	1.6	89	0.043	12.84	105	104	12.1	-0.4	303	240	332	232	265	274	1205	232	75	78	75	75	71	-0.047	11.05	0.86
125	20.099	19.969	0.16	0.16	1.33	83	1.82	1.04	84	1.6	89	0.043	12.84	105	104	11.8	-0.3	305	239	328	234	269	275	1178	227	75	78	75	74	72	-0.046	10.9	0.74
130	20.906	20.769	0.16	0.16	1.33	83	1.82	1.04	85	1.6	88	0.047	13.41	101	100	11.4	-0.4	312	238	323	237	273	277	1153	224	75	77	75	74	72	-0.045	10.66	0.65
135	21.712	21.570	0.16	0.16	1.33	83	1.82	1.04	85	1.6	88	0.046	13.27	102	101	11.1	-0.3	317	237	317	239	276	277	1129	219	75	77	75	74	72	-0.046	10.75	0.67
140	22.519	22.369	0.16	0.16	1.33	83	1.82	1.05	85	1.6	88	0.047	13.41	101	99	10.7	-0.4	320	237	311	241	280	278	1091	221	75	77	75	74	72	-0.046	10.57	0.54
145	23.326	23.170	0.16	0.16	1.33	84	1.82	1.04	85	1.6	88	0.048	13.55	99	99	10.4	-0.3	324	236	304	243	284	278	1067	219	75	77	75	74	73	-0.044	10.37	0.48
150	24.133	23.970	0.16	0.16	1.33	84	1.81	1.04	85	1.6	87	0.048	13.54	99	98	10.1	-0.3	328	235	297	244	286	278	1033	214	75	76	75	74	73	-0.043	10.28	0.36
155	24.940	24.770	0.16	0.16	1.33	84	1.81	1.04	85	1.6	87	0.048	13.54	99	98	9.8	-0.3	332	235	289	246	290	278	1002	209	75	76	75	74	72	-0.043	10.19	0.31
160	25.747	25.571	0.16	0.16	1.33	84	1.81	1.04	85	1.6	87	0.049	13.68	98	98	9.5	-0.3	332	234	285	247	291	278	1148	217	75	76	75	74	72	-0.043	10.72	0.88
165	26.554	26.370	0.16	0.16	1.34	84	1.82	1.04	85	1.6	88	0.048	13.55	99	98	9.2	-0.3	335	233	289	248	292	279	1192	219	75	76	75	74	72	-0.044	10.87	0.9
170	27.361	27.171	0.16	0.16	1.33	84	1.82	1.04	85	1.6	87	0.047	13.40	100	100	8.9	-0.3	327	233	294	249	292	279	1189	224	75	76	75	74	72	-0.044	11.32	0.91
175	28.169	27.972	0.16	0.16	1.33	84	1.82	1.04	85	1.6	88	0.047	13.41	100	100	8.5	-0.4	321	232	300	250	292	279	1214	228	75	76	75	74	72	-0.046	11.95	0.76
180	28.976	28.771	0.16	0.16	1.33	84	1.82	1.04	85	1.6	88	0.046	13.27	101	100	8.2	-0.3	322	231	308	252	293	281	1243	234	75	76	75	75	72	-0.048	12.46	0.66
185	29.783	29.572	0.16	0.16	1.33	84	1.82	1.04	85	1.6	88	0.048	13.55	99	99	7.9	-0.3	327	230	315	253	294	284	1216	235	75	76	75	75	73	-0.046	11.8	0.65
190	30.590	30.372	0.16	0.16	1.33	84	1.82	1.04	85	1.6	88	0.047	13.41	100	100	7.5	-0.4	333	229	319	255	295	286	1194	228	75	76	75	75	72	-0.047	11.43	0.61
195	31.397	31.172	0.16	0.16	1.33	84	1.82	1.04	85	1.6	87	0.049	13.68	98	97	7.2	-0.3	338	229	318	258	295	288	1182	223	75	76	75	75	72	-0.046	10.77	0.66
200	32.205	31.973	0.16	0.16	1.33	84	1.82	1.04	85	1.6	87	0.047	13.40	100	100	7.0	-0.2	345	228	314	261	296	289	1159	222	75	76	75	75	72	-0.046	10.42	0.68

Wood Heater Test Data - ASTM E2780 / ASTM E2515

Run: 1

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 19-Apr-19
Beginning Clock Time: 11:54

Total Sampling Time: 595 min
Recording Interval: 5 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.022 (1) 0.995 (2) _____ (Amb)

Barometric Pressure: Begin 30.04 Middle 30.03 End 30.01 Average 30.03 "Hg

OMNI Equipment Numbers: _____

PM Control Modules: 335, 336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.190 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 13.37 ft/sec.
Initial Tunnel Flow: 146.4 scfm
Average Tunnel Flow: 150.9 scfm
Post-Test Leak Check (1): 0.000 cfm @ 5 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 5 in. Hg
Average Test Piece Fuel Moisture: 20.87 Dry Basis %

Technician Signature: _____

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.042	0.044	0.040	0.030	0.036	0.038	0.040	0.034	0.046	"H2O
Temp:	88	87	88	88	88	88	88	88	88	°F

V_{strav} 13.26 ft/sec V_{scent} 14.46 ft/sec F_p 0.918

	Particulate Sampling Data															Fuel Weight (lb)		Temperature Data (°F)														Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	vsi	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface Temp	Catalyst Exit Temp	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
205	33.012	32.772	0.16	0.16	1.33	84	1.81	1.04	85	1.6	87	0.046	13.26	101	100	6.7	-0.3	350	228	308	263	296	289	1147	217	75	75	75	76	72	-0.044	10.36	0.73
210	33.820	33.573	0.16	0.16	1.32	84	1.82	1.04	85	1.6	87	0.048	13.54	99	99	6.4	-0.3	352	228	302	266	295	289	1135	220	75	75	75	76	72	-0.045	10.29	0.72
215	34.627	34.374	0.16	0.16	1.33	84	1.82	1.04	85	1.6	86	0.048	13.53	99	98	6.1	-0.3	354	228	296	268	295	288	1109	216	75	75	75	76	72	-0.044	10.04	0.66
220	35.435	35.174	0.16	0.16	1.33	84	1.81	1.04	85	1.6	86	0.047	13.39	100	99	5.8	-0.3	359	228	290	269	294	288	1061	210	75	75	75	76	72	-0.041	9.74	0.51
225	36.242	35.974	0.16	0.16	1.32	84	1.81	1.04	85	1.6	85	0.050	13.79	97	96	5.6	-0.2	365	227	283	271	293	288	1039	204	74	75	75	76	72	-0.041	9.42	0.54
230	37.050	36.775	0.16	0.16	1.33	84	1.81	1.04	85	1.6	85	0.048	13.52	99	98	5.4	-0.2	361	227	276	272	292	286	1027	200	74	75	74	76	71	-0.038	8.99	0.57
235	37.858	37.575	0.16	0.16	1.33	84	1.82	1.04	85	1.6	84	0.046	13.22	101	100	5.3	-0.1	354	227	270	272	290	283	1021	197	74	75	74	76	72	-0.038	8.59	0.54
240	38.666	38.376	0.16	0.16	1.34	84	1.81	1.04	85	1.6	84	0.050	13.78	97	96	5.1	-0.2	351	226	264	272	288	280	983	195	74	75	74	75	71	-0.037	8.53	0.53
245	39.474	39.176	0.16	0.16	1.33	84	1.82	1.04	85	1.6	83	0.048	13.49	99	98	5.0	-0.1	351	225	257	272	285	278	920	188	74	75	74	75	71	-0.036	8	0.35
250	40.282	39.977	0.16	0.16	1.34	84	1.81	1.04	85	1.6	83	0.050	13.77	97	96	4.9	-0.1	352	225	248	272	283	276	893	186	74	75	74	75	72	-0.036	7.83	0.35
255	41.090	40.778	0.16	0.16	1.33	84	1.82	1.04	85	1.6	83	0.047	13.35	100	99	4.8	-0.1	353	224	241	272	280	274	876	183	74	75	74	75	72	-0.035	7.96	0.36
260	41.899	41.579	0.16	0.16	1.34	83	1.81	1.04	85	1.6	83	0.049	13.63	98	97	4.6	-0.2	349	224	234	272	277	271	892	181	74	75	74	75	72	-0.035	7.96	0.47
265	42.707	42.380	0.16	0.16	1.34	83	1.81	1.04	85	1.6	83	0.048	13.49	99	98	4.5	-0.1	343	223	230	270	274	268	905	183	73	75	74	75	71	-0.036	7.86	0.47
270	43.516	43.180	0.16	0.16	1.34	83	1.82	1.04	85	1.6	82	0.049	13.62	98	97	4.4	-0.1	338	222	226	269	270	265	896	182	73	75	74	75	71	-0.036	7.92	0.47
275	44.324	43.981	0.16	0.16	1.34	83	1.82	1.04	84	1.6	82	0.050	13.76	97	96	4.3	-0.1	334	221	224	267	267	263	886	180	73	75	74	75	72	-0.035	7.72	0.46
280	45.133	44.783	0.16	0.16	1.33	83	1.82	1.04	84	1.6	82	0.050	13.76	97	96	4.2	-0.1	330	220	221	266	264	260	867	179	73	74	73	75	71	-0.035	7.45	0.45
285	45.942	45.583	0.16	0.16	1.33	83	1.81	1.04	84	1.6	81	0.049	13.61	98	97	4.1	-0.1	327	219	217	264	261	258	857	177	73	74	73	74	71	-0.033	7.39	0.45
290	46.750	46.384	0.16	0.16	1.34	83	1.81	1.04	84	1.6	81	0.049	13.61	98	97	4.0	-0.1	324	219	214	262	259	256	844	179	73	74	73	74	72	-0.033	7.25	0.44
295	47.558	47.184	0.16	0.16	1.34	83	1.81	1.04	84	1.6	82	0.049	13.62	98	97	3.9	-0.1	321	218	210	260	256	253	832	171	73	74	73	74	72	-0.032	7.15	0.44
300	48.367	47.985	0.16	0.16	1.34	83	1.81	1.04	84	1.6	81	0.050	13.74	97	96	3.8	-0.1	319	217	207	258	254	251	801	170	73	74	73	74	72	-0.031	6.95	0.36
305	49.176	48.791	0.16	0.16	1.33	83	1.81	1.08	84	1.7	80	0.049	13.59	98	98	3.8	0	317	216	203	257	251	249	774	166	73	74	73	74	71	-0.031	6.74	0.38
310	49.985	49.607	0.16	0.16	1.34	83	1.82	1.08	84	1.7	81	0.050	13.74	97	98	3.7	-0.1	313	215	199	255	248	246	781	167	73	74	73	74	71	-0.031	6.66	0.42
315	50.794	50.422	0.16	0.16	1.34	83	1.82	1.08	84	1.7	80	0.047	13.31	100	101	3.6	-0.1	310	214	196	253	246	244	778	166	73	74	73	74	71	-0.030	6.78	0.44
320	51.603	51.238	0.16	0.16	1.33	83	1.81	1.08	84	1.7	80	0.049	13.59	98	99	3.6	0	307	213	194	251	244	242	770	165	72	74	73	74	72	-0.030	6.68	0.43
325	52.412	52.054	0.16	0.16	1.33	83	1.81	1.08	84	1.7	80	0.048	13.45	99	100	3.5	-0.1	304	212	191	249	242	240	766	162	72	74	73	74	71	-0.030	6.73	0.45
330	53.221	52.869	0.16	0.16	1.33	83	1.82	1.08	84	1.7	80	0.048	13.45	99	100	3.4	-0.1	302	211	189	246	240	238	760	160	72	74	73	74	72	-0.030	6.64	0.45
335	54.030	53.684	0.16	0.16	1.33	83	1.81	1.08	84	1.7	80	0.051	13.87	96	97	3.4	0	301	209	187	244	238	236	750	161	72	74	73	73	71	-0.030	6.39	0.44
340	54.839	54.500	0.16	0.16	1.33	83	1.81	1.08	83	1.7	79	0.048	13.44	99	100	3.3	-0.1	299	208	185	242	236	234	749	160	72	74	72	73	71	-0.029	6.6	0.46
345	55.647	55.315	0.16	0.16	1.33	83	1.81	1.08	83	1.7	79	0.050	13.72	97	98	3.2	-0.1	295	207	183	240	234	232	740	158	72	74	72	73	71	-0.029	6.31	0.45
350	56.456	56.131	0.16	0.16	1.34	83	1.81	1.09	83	1.7	79	0.048	13.44	99	100	3.2	0	292	206	182	239	232	230	729	157	72	74	72	73	71	-0.029	6.12	0.44
355	57.266	56.946	0.16	0.16	1.34	82	1.81	1.08	83	1.7	79	0.050	13.72	97	98	3.1	-0.1	289	205	180	237	230	228	712	156	72	74	72	73	71	-0.029	5.94	0.44
360	58.075	57.761	0.16	0.16	1.34	82	1.82	1.08	83	1.7	79	0.047	13.30	100	101	3.1	0	286	203	178	235	228	226	705	157	72	74	72	73	71	-0.028	5.89	0.44
365	58.884	58.577	0.16	0.16	1.34	82	1.81	1.08	83	1.7	78	0.049	13.57	98	99	3.0	-0.1	284	202	176	234	226	224	697	155	72	74	72	73	71	-0.028	5.98	0.45
370	59.692	59.392	0.16	0.16	1.34	82	1.81	1.08	83	1.7	78	0.050	13.71	97	98	3.0	0	282	201	174	233	224	223	693	155	71	74	72	73	71	-0.028	5.91	0.45
375	60.501	60.208	0.16	0.16	1.35	82	1.81	1.09	83	1.7	78	0.050	13.71	97	98	2.9	-0.1	276	200	172	231	222	220	693	154	71	74	72	73	71	-0.028	6.58	0.48
380	61.310	61.023	0.16	0.16	1.34	82	1.81	1.08	83	1.7	78	0.049	13.57	98	99	2.8	-0.1	279	198	170	230	220	219	700	154	71	74	72	73	71	-0.027	6.32	0.48
385	62.120	61.839	0.16	0.16	1.34	82	1.81	1.08	83	1.7	78	0.049	13.57	98	99	2.8	0	278	197	169	228	218	218	695	153	71	74	72	73	71	-0.027	6.16	0.48
390	62.929	62.654	0.16	0.16	1.34	82	1.81	1.08	83	1.7	78	0.048	13.43	99	100	2.7	-0.1	277	196	169	226	217	217	686	152	71	73	72	73	71	-0.027	6.1	0.48
395	63.738	63.469	0.16	0.16	1.34	82	1.81	1.08	83	1.7	77	0.047	13.28	100	101	2.6	-0.1	276	195	167	225	216	216	685	151	71	73	71	72	71	-0.027	6.16	0.48

Wood Heater Test Data - ASTM E2780 / ASTM E2515

Run: 1

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 19-Apr-19
Beginning Clock Time: 11:54

Total Sampling Time: 595 min
Recording Interval: 5 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.022 (1) 0.995 (2) _____ (Amb)

Barometric Pressure: Begin 30.04 Middle 30.03 End 30.01 Average 30.03 "Hg

OMNI Equipment Numbers: _____

PM Control Modules: 335, 336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.190 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 13.37 ft/sec.
Initial Tunnel Flow: 146.4 scfm
Average Tunnel Flow: 150.9 scfm
Post-Test Leak Check (1): 0.000 cfm @ 5 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 5 in. Hg
Average Test Piece Fuel Moisture: 20.87 Dry Basis %

Technician Signature: _____

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.042	0.044	0.040	0.030	0.036	0.038	0.040	0.034	0.046	"H2O
Temp:	88	87	88	88	88	88	88	88	88	°F

V_{strav} 13.26 ft/sec V_{scent} 14.46 ft/sec F_p 0.918

	Particulate Sampling Data															Fuel Weight (lb)		Temperature Data (°F)													Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	vsi	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface Temp	Catalyst Exit Temp	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
400	64.548	64.285	0.16	0.16	1.34	82	1.81	1.07	82	1.7	77	0.049	13.56	98	99	2.6	0	275	194	166	224	214	215	684	153	71	73	71	72	70	-0.027	6.18	0.48
405	65.357	65.100	0.16	0.16	1.34	82	1.81	1.08	82	1.7	77	0.049	13.56	98	99	2.5	-0.1	274	193	165	222	213	213	677	152	71	73	71	72	71	-0.027	5.95	0.48
410	66.166	65.915	0.16	0.16	1.33	82	1.81	1.08	82	1.7	77	0.050	13.69	97	98	2.4	-0.1	272	191	164	221	212	212	669	148	71	73	71	72	71	-0.026	5.76	0.47
415	66.976	66.731	0.16	0.16	1.33	82	1.81	1.08	82	1.6	77	0.048	13.42	99	100	2.4	0	270	190	163	220	210	211	658	149	71	73	71	72	70	-0.027	5.58	0.46
420	67.785	67.546	0.16	0.16	1.33	82	1.81	1.09	82	1.7	77	0.049	13.56	98	99	2.3	-0.1	273	189	161	219	209	210	670	150	71	73	71	72	70	-0.027	6.03	0.49
425	68.595	68.361	0.16	0.16	1.33	81	1.81	1.08	82	1.6	76	0.047	13.26	100	101	2.3	0	273	189	161	219	208	210	674	149	71	73	71	72	69	-0.026	5.95	0.5
430	69.404	69.177	0.16	0.16	1.33	81	1.81	1.08	82	1.7	77	0.048	13.42	99	100	2.2	-0.1	274	188	161	219	207	210	678	150	71	73	71	72	69	-0.026	6.43	0.54
435	70.214	69.992	0.16	0.16	1.34	81	1.81	1.09	82	1.7	76	0.047	13.26	100	101	2.1	-0.1	276	187	160	220	206	210	687	149	71	73	71	72	69	-0.027	6.67	0.55
440	71.023	70.808	0.16	0.16	1.34	81	1.81	1.08	82	1.7	76	0.048	13.40	99	100	2.0	-0.1	278	186	160	219	206	210	681	150	71	73	71	72	69	-0.026	6.56	0.54
445	71.832	71.623	0.16	0.16	1.34	81	1.81	1.09	82	1.7	77	0.049	13.56	98	99	2.0	0	278	185	159	218	206	209	672	149	71	73	71	72	70	-0.026	6.28	0.53
450	72.641	72.439	0.16	0.16	1.35	81	1.81	1.08	82	1.7	76	0.049	13.54	98	99	1.9	-0.1	279	185	159	217	206	209	664	146	71	73	71	72	70	-0.026	6.16	0.52
455	73.450	73.254	0.16	0.16	1.35	81	1.81	1.08	82	1.7	77	0.049	13.56	98	99	1.8	-0.1	279	184	158	216	206	209	658	147	71	73	71	72	69	-0.026	6.05	0.52
460	74.260	74.069	0.16	0.16	1.35	81	1.81	1.08	82	1.6	76	0.048	13.40	99	100	1.8	0	278	183	157	216	206	208	653	147	71	72	71	72	69	-0.026	6.18	0.54
465	75.069	74.885	0.16	0.16	1.34	81	1.81	1.08	82	1.6	76	0.048	13.40	99	100	1.7	-0.1	279	183	157	215	206	208	657	147	71	72	71	72	70	-0.026	6.32	0.54
470	75.878	75.700	0.16	0.16	1.34	81	1.81	1.08	82	1.7	76	0.048	13.40	99	100	1.6	-0.1	279	182	156	214	206	207	651	148	70	72	71	71	70	-0.025	6.21	0.54
475	76.688	76.515	0.16	0.16	1.34	81	1.81	1.08	82	1.7	76	0.048	13.40	99	100	1.6	0	279	182	156	213	206	207	642	145	70	72	71	71	70	-0.026	6.03	0.53
480	77.498	77.331	0.16	0.16	1.34	81	1.81	1.08	82	1.6	76	0.047	13.26	100	101	1.5	-0.1	278	181	155	212	206	206	641	143	70	72	71	71	69	-0.025	6.01	0.53
485	78.307	78.146	0.16	0.16	1.33	81	1.81	1.08	82	1.7	76	0.048	13.40	99	100	1.4	-0.1	276	181	154	211	205	205	635	146	70	72	71	71	69	-0.025	5.84	0.53
490	79.117	78.961	0.16	0.16	1.33	81	1.81	1.09	82	1.7	76	0.046	13.12	101	102	1.4	0	274	180	153	211	205	205	627	142	70	72	71	71	69	-0.025	5.72	0.51
495	79.927	79.777	0.16	0.16	1.34	81	1.81	1.08	82	1.7	75	0.050	13.67	97	98	1.3	-0.1	272	179	152	211	204	204	620	143	70	72	70	71	69	-0.025	5.59	0.51
500	80.736	80.592	0.16	0.16	1.34	81	1.81	1.08	82	1.7	75	0.049	13.53	98	99	1.3	0	271	179	151	210	203	203	614	143	70	72	70	71	69	-0.026	5.53	0.51
505	81.546	81.408	0.16	0.16	1.34	81	1.81	1.08	81	1.7	75	0.048	13.39	99	100	1.2	-0.1	269	178	151	210	202	202	608	140	70	72	70	71	69	-0.025	5.46	0.51
510	82.356	82.223	0.16	0.16	1.34	81	1.81	1.08	82	1.7	75	0.049	13.53	98	99	1.1	-0.1	267	177	150	210	200	201	605	139	70	72	70	71	69	-0.024	5.41	0.51
515	83.165	83.039	0.16	0.16	1.35	81	1.81	1.09	81	1.6	75	0.049	13.53	98	99	1.1	0	266	176	148	209	199	200	600	138	70	72	70	71	69	-0.024	5.32	0.51
520	83.975	83.854	0.16	0.16	1.34	81	1.81	1.09	81	1.7	75	0.047	13.25	100	101	1.0	-0.1	264	176	147	208	197	198	628	140	70	72	70	71	69	-0.024	6.5	0.6
525	84.785	84.669	0.16	0.16	1.35	81	1.81	1.09	81	1.7	75	0.050	13.67	97	98	0.9	-0.1	262	175	148	207	195	197	636	142	70	72	70	71	69	-0.024	6.26	0.58
530	85.594	85.485	0.16	0.16	1.35	81	1.8	1.08	81	1.6	75	0.048	13.39	99	100	0.9	0	261	174	148	207	194	197	631	141	69	72	70	71	70	-0.026	6.19	0.59
535	86.405	86.301	0.16	0.16	1.34	81	1.81	1.08	81	1.7	75	0.048	13.39	99	100	0.8	-0.1	260	174	148	206	193	196	629	141	69	72	70	71	69	-0.025	5.97	0.6
540	87.215	87.116	0.16	0.16	1.35	81	1.81	1.09	81	1.6	75	0.048	13.39	99	100	0.7	-0.1	259	173	148	205	192	195	622	144	69	71	70	71	69	-0.025	5.86	0.6
545	88.025	87.931	0.16	0.16	1.34	81	1.8	1.09	81	1.7	75	0.048	13.39	99	100	0.6	-0.1	258	173	147	205	191	195	613	141	69	71	70	71	69	-0.025	5.72	0.61
550	88.835	88.747	0.16	0.16	1.34	80	1.81	1.09	81	1.7	75	0.049	13.53	98	99	0.6	0	257	173	147	205	190	194	604	142	69	71	70	70	69	-0.025	5.5	0.61
555	89.645	89.562	0.16	0.16	1.34	80	1.81	1.09	81	1.6	75	0.048	13.39	99	100	0.5	-0.1	255	173	146	204	190	194	600	141	69	71	70	70	69	-0.025	5.34	0.61
560	90.455	90.378	0.16	0.16	1.34	80	1.8	1.08	81	1.7	74	0.049	13.52	98	99	0.5	0	253	173	145	204	189	193	591	139	69	71	70	70	69	-0.024	5.33	0.63
565	91.264	91.193	0.16	0.16	1.34	80	1.81	1.09	81	1.6	74	0.049	13.52	98	99	0.4	-0.1	250	173	144	203	188	192	579	138	69	71	70	70	69	-0.024	5.16	0.63
570	92.074	92.009	0.16	0.16	1.35	80	1.8	1.09	81	1.6	74	0.049	13.52	98	99	0.3	-0.1	249	172	143	203	186	191	567	137	69	71	70	70	68	-0.023	4.92	0.63
575	92.883	92.824	0.16	0.16	1.35	80	1.81	1.08	81	1.6	74	0.050	13.65	97	98	0.3	0	245	172	142	203	185	189	562	133	69	71	70	70	68	-0.023	4.94	0.65
580	93.693	93.640	0.16	0.16	1.35	80	1.81	1.09	81	1.6	74	0.048	13.38	99	100	0.2	-0.1	242	172	141	203	183	188	554	134	69	71	69	70	68	-0.023	4.74	0.65
585	94.503	94.456	0.16	0.16	1.34	80	1.8	1.08	81	1.6	74	0.048	13.38	99	100	0.2	0	240	171	140	203	181	187	544	133	69	71	69	70	68	-0.023	4.7	0.67
590	95.313	95.271	0.16	0.16	1.34	80	1.81	1.09	81	1.7	74	0.050	13.65	97	98	0.1	-0.1	238	171	139	204	180	186	538	132	69	71	69	70	68	-0.022	4.62	0.68
595	96.123	96.087	0.16	0.16	1.34	80	1.81	1.08	81	1.7	73	0.046	13.08	101	102	0.0	-0.1	236	170	138	204	178	185	532	130	69	71	69	70	68	-0.022	4.6	0.71
Avg/Tot	96.123	96.087	0.16	0.16	1.33	82		1.06	83		82	0.047		100	100								117.8				75	73	73	71	-0.035		

OMNI-Test Laboratories

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Date: 04/19/19
Run: 1
Control #: 0135WS043E
Test Duration: 595
Output Category: 2

Technicians: _____

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	79.0%	85.4%
Combustion Efficiency	94.2%	94.2%
Heat Transfer Efficiency	84%	90.7%

Output Rate (kJ/h)	12,623	11,974	**(Btu/h)**
Burn Rate (kg/h)	0.81	1.78	**(lb/h)**
Input (kJ/h)	15,974	15,153	**(Btu/h)**

Test Load Weight (dry kg)	8.00	17.62	**dry lb**
MC wet (%)	17.26		
MC dry (%)	20.86		
Particulate (g)	6.29		
CO (g)	663		
Test Duration (h)	9.92		

Emissions	Particulate	CO
g/MJ Output	0.05	5.30
g/kg Dry Fuel	0.79	82.92
g/h	0.63	66.86
lb/MM Btu Output	0.12	12.31

Air/Fuel Ratio (A/F)	14.13

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

VERSION: 2.2 12/14/2009

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Date: 4/19/2019
Run: 1
Control #: 0135WS043E
Test Duration: 595
Output Category: 2

Appliance Type: Cat

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

Fuel Data

		D. Fir	
Wood Moisture (% wet):	17.26	**HHV**	19,810 kj/kg
Load Weight (lb wet):	21.30	**%C**	48.73
Burn Rate (dry kg/h):	0.81	**%H**	6.87
Total Particulate Emissions:	6.29 g	**%O**	43.9
		%ASH	0.5

Averages	**0.62**	**8.02**	**#DIV/0!**	**182.40**	**70.83**
					Temp. (ºF)
Elapsed Time (min)	**Fuel Weight Remaining (lb)**	**Flue Gas Composition (%) CO**	**CO_2**	**O_2**	**Flue Gas**	**Room Temp**
0	21.30	0.22	8.28		229.0	73.0
5	21.00	1.11	9.72		217.0	73.0
10	20.70	0.93	9.74		221.0	73.0
15	20.40	0.55	10.00		217.0	72.0
20	20.10	0.52	10.13		222.0	73.0
25	19.80	0.66	10.47		226.0	71.0
30	19.50	0.74	10.33		225.0	71.0
35	19.10	0.77	10.40		224.0	71.0
40	18.70	0.67	10.80		232.0	72.0
45	18.30	0.88	11.34		235.0	72.0
50	17.90	0.69	10.81		239.0	71.0
55	17.50	0.92	10.51		232.0	71.0
60	17.10	1.01	10.55		232.0	71.0
65	16.70	1.15	10.90		233.0	71.0
70	16.30	1.15	11.07		234.0	71.0
75	15.90	1.07	11.09		234.0	72.0
80	15.40	1.06	11.15		233.0	71.0
85	15.00	0.83	11.34		238.0	72.0
90	14.70	0.91	11.54		232.0	71.0
95	14.20	1.29	11.88		242.0	71.0
100	13.80	1.52	11.88		240.0	72.0
105	13.30	1.43	11.60		240.0	72.0

110	12.90	1.19	11.38		235.0	72.0
115	12.50	1.20	11.41		233.0	73.0
120	12.10	0.86	11.05		232.0	71.0
125	11.80	0.74	10.90		227.0	72.0
130	11.40	0.65	10.66		224.0	72.0
135	11.10	0.67	10.75		219.0	72.0
140	10.70	0.54	10.57		221.0	72.0
145	10.40	0.48	10.37		219.0	73.0
150	10.10	0.36	10.28		214.0	73.0
155	9.80	0.31	10.19		209.0	72.0
160	9.50	0.88	10.72		217.0	72.0
165	9.20	0.90	10.87		219.0	72.0
170	8.90	0.91	11.32		224.0	72.0
175	8.50	0.76	11.95		228.0	72.0
180	8.20	0.66	12.46		234.0	72.0
185	7.90	0.65	11.80		235.0	73.0
190	7.50	0.61	11.43		228.0	72.0
195	7.20	0.66	10.77		223.0	72.0
200	7.00	0.68	10.42		222.0	72.0
205	6.70	0.73	10.36		217.0	72.0
210	6.40	0.72	10.29		220.0	72.0
215	6.10	0.66	10.04		216.0	72.0
220	5.80	0.51	9.74		210.0	72.0
225	5.60	0.54	9.42		204.0	72.0
230	5.40	0.57	8.99		200.0	71.0
235	5.30	0.54	8.59		197.0	72.0
240	5.10	0.53	8.53		195.0	71.0
245	5.00	0.35	8		188	71
250	4.90	0.35	7.83		186	72
255	4.80	0.36	7.96		183	72
260	4.60	0.47	7.96		181	72
265	4.50	0.47	7.86		183	71
270	4.40	0.47	7.92		182	71
275	4.30	0.46	7.72		180	72
280	4.20	0.45	7.45		179	71
285	4.10	0.45	7.39		177	71
290	4.00	0.44	7.25		179	72
295	3.90	0.44	7.15		171	72
300	3.80	0.36	6.95		170	72
305	3.80	0.38	6.74		166	71
310	3.70	0.42	6.66		167	71
315	3.60	0.44	6.78		166	71

320	3.60	0.43	6.68		165	72
325	3.50	0.45	6.73		162	71
330	3.40	0.45	6.64		160	72
335	3.40	0.44	6.39		161	71
340	3.30	0.46	6.6		160	71
345	3.20	0.45	6.31		158	71
350	3.20	0.44	6.12		157	71
355	3.10	0.44	5.94		156	71
360	3.10	0.44	5.89		157	71
365	3.00	0.45	5.98		155	71
370	3.00	0.45	5.91		155	71
375	2.90	0.48	6.58		154	71
380	2.80	0.48	6.32		154	71
385	2.80	0.48	6.16		153	71
390	2.70	0.48	6.1		152	71
395	2.60	0.48	6.16		151	71
400	2.60	0.48	6.18		153	70
405	2.50	0.48	5.95		152	71
410	2.40	0.47	5.76		148	71
415	2.40	0.46	5.58		149	70
420	2.30	0.49	6.03		150	70
425	2.30	0.5	5.95		149	69
430	2.20	0.54	6.43		150	69
435	2.10	0.55	6.67		149	69
440	2.00	0.54	6.56		150	69
445	2.00	0.53	6.28		149	70
450	1.90	0.52	6.16		146	70
455	1.80	0.52	6.05		147	69
460	1.80	0.54	6.18		147	69
465	1.70	0.54	6.32		147	70
470	1.60	0.54	6.21		148	70
475	1.60	0.53	6.03		145	70
480	1.50	0.53	6.01		143	69
485	1.40	0.53	5.84		146	69
490	1.40	0.51	5.72		142	69
495	1.30	0.51	5.59		143	69
500	1.30	0.51	5.53		143	69
505	1.20	0.51	5.46		140	69
510	1.10	0.51	5.41		139	69
515	1.10	0.51	5.32		138	69
520	1.00	0.6	6.5		140	69
525	0.90	0.58	6.26		142	69

530	0.90	0.59	6.19		141	70
535	0.80	0.6	5.97		141	69
540	0.70	0.6	5.86		144	69
545	0.60	0.61	5.72		141	69
550	0.60	0.61	5.5		142	69
555	0.50	0.61	5.34		141	69
560	0.50	0.63	5.33		139	69
565	0.40	0.63	5.16		138	69
570	0.30	0.63	4.92		137	68
575	0.30	0.65	4.94		133	68
580	0.20	0.65	4.74		134	68
585	0.20	0.67	4.7		133	68
590	0.10	0.68	4.62		132	68
595	0.00	0.71	4.6		130	68

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 1

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/19/19

Test Crew: D Davis R Tiess

OMNI Equipment ID numbers:

Wood Heater Fuel Data

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

Pre-Burn Fuel

Calibration: Cal Value (1) = 12% Actual Reading 12

Cal Value (2) = 22% Actual Reading 22

Piece:	Length:	Reading:	Piece:	Length:	Reading:
1	48 in	21.9	7	____ in	____
2	48 in	22.0	8	____ in	____
3	48 in	22.8	9	____ in	____
4	48 in	22.5	10	____ in	____
5	48 in	22.4	11	____ in	____
6	48 in	23.8	12	____ in	____

Total Pre-Burn Fuel Weight: 29.1 Pre-Burn Fuel Average Moisture:

Time (clock): 1015 Room Temperature (F): 69 Initials: BR

Test Fuel

Firebox Volume (ft^3): 3.25 Test Fuel Piece Length (in): 20"

Load Weight Range (lb): 2275 (20.5 ~ 25.0) Total Wet Fuel Load Weight (lb): 21.3

Fuel Type & Amount: 2 x 4: 0 4 x 4: 4

Weight (with spacers): 0 Weight (with spacers): 21.3

Piece:	Weight (lbs):	Moisture Readings (%DB):			Fuel Type:
1	4.7	21.9	22.4	20.5	4x4
2	5.3	22.3	18.7	24.1	4x4
3	4.5	19.5	18.5	19.3	4x4
4	5.3	22.5	18.7	22.0	4x4
5					
6					
7					

Spacer Moisture Readings (%DB)

10.8	9.4	10.2	9.3				
9.6	10.2	9.5	10.2				
10.1	11.0	10.0	10.7				
10.2	10.5	10.4	10.0				

Time (clock): 11:15 Room Temperature (F): 69.8 Initials: BR

Technician Signature: Date: 5/7/19

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 1

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/19/19

Test Crew: B Davis R Tiegs

OMNI Equipment ID numbers: 132, 414, 371, 372, 559, 185, 594

Wood Heater Run Notes

Air Control Settings

Primary:

Air control Turned fully counter clockwise. Full closed

Secondary: fixed

Tertiary/Pilot: fixed

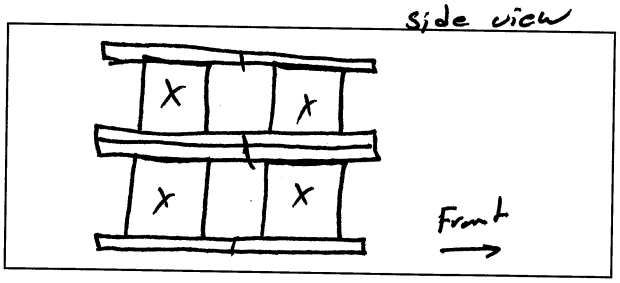
Fan: On Low

Preburn Notes

Time	Notes
0	
23	Stirred fuel
47	Stirred fuel
66	Flattened coal bed

Test Notes

Sketch test fuel configuration:



Start up procedures & Timeline:

Bypass: open until 60 seconds then closed

Fuel loaded by: 60 seconds

Door closed at: 60 seconds

Primary air: Air test setting (fully closed) entire test

Notes: FAN on Low entire test.

Time	Notes
60	Changed front filter in tr Air A.

Technician Signature: [signature] Date: 5/3/19

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 1

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/19/19

Test Crew: B Davis, R Tiggs

OMNI Equipment ID numbers:

Wood Heater Supplemental Data

Start Time: 11:54 Booth #: E1

Stop Time: 2149

Stack Gas Leak Check:

Initial: good Final: good

Sample Train Leak Check:

A: 0.0 @ 5 "Hg

B: 0.0 @ 5 "Hg

Calibrations: Span Gas CO_2: 10.08 CO: 2.53

	Pre Test		Post Test	
	Zero	Span	Zero	Span
Time	1148	1148	2220	2220
CO_2	0.00	9.97	0.01	9.97
CO	0.000	2.522	0.000	2.525

Air Velocity (ft/min): Initial: 250 Final: 250

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

Pitot Tube Leak Test: Initial: good Final: good

Stack Diameter (in): 6"

Induced Draft: 0.0

% Smoke Capture: 100 %

Flue Pipe Cleaned Prior to First Test in Series:

Date: 4/18/19 Initials:

	Initial	Middle	Ending
P_b (in/Hg)	30.04		30.01
RH (%)	40.8		50.1
Ambient (°F)	73		68

Tunnel Traverse

Microtector Reading	dP (in H_2O)	T(°F)
	.042	88
	.044	88
	.040	88
	.036	88
	.036	88
	.038	88
	.040	88
	.034	88
Center:		
	.046	88

Tunnel Static Pressure (in H_2O):	
Beginning of Test	End of Test
-.19	-.19

Background Filter Volume: N/A

Technician Signature:

Date: 5/3/19

Run 2

Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: Hearth & Home
Model: Defiant
Project No.: 0135WS043E
Tracking No.: 2366
Run: 2
Test Date: 04/22/19

Burn Rate	**1.78 kg/hr dry**
Average Tunnel Temperature	92 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	19.12 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	12826.2 dscf/hour
Average Delta p	0.100 inches H20
Total Time of Test	285 minutes

	AMBIENT	SAMPLE TRAIN 1	SAMPLE TRAIN 2	FIRST HOUR FILTER (TRAIN 1)
Total Sample Volume - Vm	0.000 cubic feet	45.950 cubic feet	46.436 cubic feet	9.627 cubic feet
Average Gas Meter Temperature	73 degrees Fahrenheit	83 degrees Fahrenheit	84 degrees Fahrenheit	83 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	0.000 dscf	46.416 dscf	45.578 dscf	9.725 dscf
Total Particulates - m_n	0 mg	9.4 mg	9.9 mg	2.4 mg
Particulate Concentration (dry-standard) - C_f/C_s	0.000000 grams/dscf	0.00020 grams/dscf	0.00022 grams/dscf	0.00025 grams/dscf
Total Particulate Emissions - E_T	0.00 grams	12.34 grams	13.23 grams	3.17 grams
Particulate Emission Rate	0.00 grams/hour	2.60 grams/hour	2.79 grams/hour	3.17 grams/hour
Emissions Factor		1.46 g/kg	1.57 g/kg	1.18 g/kg
Difference from Average Total Particulate Emissions		0.45 grams	0.45 grams	

Dual Train Comparison Results Are Acceptable

FINAL AVERAGE RESULTS

Complete Test Run	
Total Particulate Emissions - E_T	12.79 grams
Particulate Emission Rate	**2.69 grams/hour**
Emissions Factor	1.51 grams/kg
First Hour Emissions	
Total Particulate Emissions - E_T	3.17 grams
Particulate Emission Rate	3.17 grams/hour
Emissions Factor	1.18 grams/kg

QUALITY CHECKS

Filter Temps < 90 °F	OK
Filter Face Velocity (47 mm)	OK
Dryer Exit Temp < 80F	OK
Leakage Rate	OK
Ambient Temp (55-90°F)	OK
Negative Probe Weight Eval.	OK
Pro-Rate Variation	OK
Stove Surface ΔT	OK
Train Precision 7.5%	3.50
Train Precision 0.5g/kg	0.11

Technician Signature:_____

Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: Hearth & Home
Model: Defiant
Project No.: 0135WS043E
Tracking No.: 2366
Run: 2
Test Date: 04/22/19

Uncorrected

Burn Rate	**1.78 kg/hr dry**
Average Tunnel Temperature	92 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	19.12 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	12826.2 dscf/hour
Average Delta p	0.100 inches H20
Total Time of Test	285 minutes

	AMBIENT	SAMPLE TRAIN 1	SAMPLE TRAIN 2	FIRST HOUR FILTER (TRAIN 1)
Total Sample Volume - Vm	0.000 cubic feet	45.950 cubic feet	46.436 cubic feet	9.627 cubic feet
Average Gas Meter Temperature	73 degrees Fahrenheit	83 degrees Fahrenheit	84 degrees Fahrenheit	83 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	0.000 dscf	46.416 dscf	45.578 dscf	9.725 dscf
Total Particulates - m_n	0 mg	9.7 mg	9.9 mg	2.4 mg
Particulate Concentration (dry-standard) - C_f/C_s	0.000000 grams/dscf	0.00021 grams/dscf	0.00022 grams/dscf	0.00025 grams/dscf
Total Particulate Emissions - E_T	0.00 grams	12.73 grams	13.23 grams	3.17 grams
Particulate Emission Rate	0.00 grams/hour	2.68 grams/hour	2.79 grams/hour	3.17 grams/hour
Emissions Factor		1.51 g/kg	1.57 g/kg	1.18 g/kg
Difference from Average Total Particulate Emissions		0.25 grams	0.25 grams	

Dual Train Comparison Results Are Acceptable

FINAL AVERAGE RESULTS

Complete Test Run	
Total Particulate Emissions - E_T	12.98 grams
Particulate Emission Rate	**2.73 grams/hour**
Emissions Factor	1.54 grams/kg
First Hour Emissions	
Total Particulate Emissions - E_T	3.17 grams
Particulate Emission Rate	3.17 grams/hour
Emissions Factor	1.18 grams/kg

QUALITY CHECKS

Filter Temps < 90 °F	OK
Filter Face Velocity (47 mm)	OK
Dryer Exit Temp < 80F	OK
Leakage Rate	OK
Ambient Temp (55-90°F)	OK
Negative Probe Weight Eval.	OK
Pro-Rate Variation	OK
Stove Surface ΔT	OK
Train Precision 7.5%	1.93
Train Precision 0.5g/kg	0.06

Technician Signature:_____

Wood Heater Preburn Data - ASTM E2780

Run:	**2**
Manufacturer:	Hearth & Home
Model:	Defiant 1975-CAT-C
Tracking No.:	2366
Project No.:	0135WS043E
Test Date:	43577
Beginning Clock Time:	10:47

Coal Bed Range (lb):	**4.4** (min)	**5.6** (max)

Technician Signature:

			Temperatures (°F)							
Elapsed Time (min)	Scale (lb)	Stack Draft (in H_2O)	FB Top	FB Bottom	FB Back	FB Left	FB Right	Avg. Firebox Surface	Stack	Ambient
0	12	-0.071	618	338	192	319	302	353.8	493	71
5	10.8	-0.056	589	349	207	343	324	362.4	276	71
10	10	-0.055	581	345	191	315	289	344.2	264	71
15	9.3	-0.054	564	337	184	292	270	329.4	266	72
20	8.6	-0.053	556	329	189	276	259	321.8	263	72
25	8	-0.053	544	320	194	265	252	315	266	72
30	7	-0.056	544	311	197	263	248	312.6	288	73
35	6.4	-0.055	501	298	202	261	243	301	269	72
40	5.8	-0.055	449	288	211	253	235	287.2	273	72
45	5.5	-0.053	436	280	219	247	228	282	267	72
50	5.2	-0.051	421	275	222	243	223	276.8	264	71
55	4.9	-0.051	414	272	221	241	220	273.6	260	71
60	4.7	-0.048	409	270	217	241	218	271	251	72

Wood Heater Test Fuel Data - ASTM E2780

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 4/22/2019
Run No.: 2

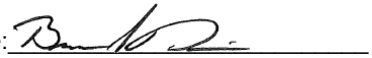
Firebox Volume (ft^3):	3.25
Fuel Piece Length (in):	20
2x4 Crib Weight (lb):	
4x4 Crib Weight (lb):	22.2

Total Fuel Weight (Dry Basis, lb):	18.6	
Fuel Density (lb/ft^3, Dry Basis):	30.38	OK
Loading Density (lb/ft^3, Wet Basis):	6.83	OK
2x4 Percentage:	N/A	N/A

Coal Bed Range (20-25%): **4.44 - 5.55**

Test Fuel Piece	Weight (lb)	Size	Readings (Dry Basis %)			Dry Weight (lb)
1	4.5	4"x 4"	19.7	20.6	20.8	3.74
2	5.1	4"x 4"	19.2	18.8	19.6	4.28
3	6	4"x 4"	20.0	19.2	21.4	4.99
4	5.1	4"x 4"	21.7	18.4	22.3	4.22

Spacer Readings (Dry Basis %)			
9.2	9.3		
8.8	9.4		
10.0	8.8		
8.5			
9.4			
9.1			
8.7			
8.9			
10.0			
9.0			
8.2			
9.2			
8.6			

Technician Signature: 

Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-
Tracking No. 2366
Project No.: 0135WS043E
Run #: 2
Date: 4/22/19

Equipment Numbers: 283A, 637, 592

TRAIN 1 (First Hour emissions)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	D745	123.9	121.5	2.4
C. Rear filter catch	Filter				0.0
D. Probe catch*	Probe				0.0
E. Filter seals catch*	Seals				0.0

Sub-Total Total Particulate, mg: 2.4

TRAIN 1 (Post First Hour Change-out)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	D746	126.9	121.8	5.1
C. Rear filter catch	Filter	D747	120.3	120.6	-0.3
D. Probe catch*	Probe	58	117067.4	117066.0	1.4
E. Filter seals catch*	Seals	R765	3320.2	3319.4	0.8

Sub-Total Total Particulate, mg: 7.0

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

TRAIN 2

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	D748	127.8	119.9	7.9
B. Rear filter catch	Filter	D749	121.7	121.1	0.6
C. Probe catch*	Probe	62	117661.5	117661.0	0.5
D. Filter seals catch*	Seals	R766	3346.9	3346.0	0.9

Total Particulate, mg: **9.9**

AMBIENT

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

Total Particulate, mg: **0.0**

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

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

Technician Signature: 

Wood Heater Test Data - ASTM E2780 / ASTM E2515

Run: 2

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 22-Apr-19
Beginning Clock Time: 11:50

Total Sampling Time: 285 min
Recording Interval: 5 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.022 (1) 0.995 (2) _____ (Amb)

Barometric Pressure:

Begin	Middle	End	Average
30.34	30.32	30.3	30.32 "Hg

OMNI Equipment Numbers: _____

PM Control Modules: 335, 336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.350 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 19.12 ft/sec.
Initial Tunnel Flow: 211.5 scfm
Average Tunnel Flow: 213.8 scfm
Post-Test Leak Check (1): 0.000 cfm @ 6 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 8 in. Hg
Average Test Piece Fuel Moisture: 20.14 Dry Basis %

Technician Signature: _____

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.064	0.096	0.084	0.074	0.064	0.090	0.096	0.068	0.101	"H2O
Temp:	90	90	91	92	94	94	94	94	91	°F

V_{strav} 19.20 ft/sec V_{scent} 21.38 ft/sec F_p 0.898

	Particulate Sampling Data															Fuel Weight (lb)		Temperature Data (°F)														Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface Temp	Catalyst Exit Temp	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
0	0.000	0.000			0.97	75	1.62	0.77	76	1.7	115	0.101			22.2		417	270	214	242	220	273	1041	299	72	70	72	68	73	-0.053	10.57	0.83
5	0.804	0.782	0.16	0.16	1.38	75	1.87	1.07	77	1.8	92	0.099	102	98	21.8	-0.4	353	267	212	239	220	258	1060	257	74	72	74	70	72	-0.052	10.11	0.13
10	1.610	1.581	0.16	0.16	1.36	76	1.85	1.06	77	1.8	90	0.099	102	100	21.4	-0.4	310	263	219	221	209	244	1129	269	74	72	74	68	72	-0.055	10.84	0.11
15	2.411	2.382	0.16	0.16	1.32	76	1.82	1.10	78	1.8	89	0.101	100	99	20.9	-0.5	290	259	229	206	199	237	1156	281	74	72	74	68	71	-0.055	10.49	0.07
20	3.204	3.196	0.16	0.16	1.33	77	1.82	1.10	78	1.8	92	0.103	98	99	20.5	-0.4	278	255	238	194	191	231	1210	290	74	72	75	69	71	-0.058	11.8	0.07
25	4.003	4.009	0.16	0.16	1.34	78	1.84	1.10	79	1.8	92	0.098	101	102	20.0	-0.5	272	252	247	187	187	229	1238	298	75	72	75	69	72	-0.059	11.79	0.05
30	4.805	4.822	0.16	0.16	1.35	79	1.84	1.10	79	1.8	93	0.096	102	103	19.5	-0.5	269	248	256	181	185	228	1270	303	75	73	75	70	71	-0.059	12.13	0.05
35	5.608	5.635	0.16	0.16	1.34	79	1.84	1.09	80	1.8	94	0.099	101	101	18.9	-0.6	271	245	265	178	184	229	1330	318	75	73	75	70	71	-0.061	13.19	0.08
40	6.411	6.449	0.16	0.16	1.35	80	1.85	1.09	81	1.8	96	0.100	100	101	18.3	-0.6	285	243	276	176	185	233	1384	330	75	73	75	71	72	-0.062	13.95	0.22
45	7.215	7.263	0.16	0.16	1.35	80	1.84	1.10	81	1.8	98	0.100	101	101	17.5	-0.8	334	240	290	178	188	246	1404	344	75	74	76	72	71	-0.065	13.6	0.76
50	8.019	8.077	0.16	0.16	1.34	81	1.85	1.10	82	1.8	98	0.099	101	101	16.8	-0.7	343	238	295	183	194	251	1354	336	76	74	76	72	71	-0.064	12.81	1.16
55	8.823	8.891	0.16	0.16	1.34	81	1.86	1.10	82	1.8	99	0.098	102	102	16.0	-0.8	357	236	295	196	197	256	1354	339	76	74	76	73	72	-0.066	12.9	3.85
60	9.627	9.706	0.16	0.16	1.34	81	1.85	1.10	82	1.8	99	0.100	101	101	15.1	-0.9	363	234	291	222	201	262	1310	332	76	75	76	73	72	-0.065	12.82	3.27
65	10.433	10.521	0.16	0.16	1.34	82	1.86	1.10	83	1.8	98	0.100	101	101	14.3	-0.8	381	233	283	246	203	269	1301	322	77	75	76	74	71	-0.064	12.74	2.78
70	11.237	11.335	0.16	0.16	1.34	82	1.86	1.10	83	1.8	98	0.099	101	101	13.5	-0.8	404	231	279	259	206	276	1301	330	77	76	76	74	73	-0.063	12.9	2.57
75	12.042	12.150	0.16	0.16	1.34	82	1.86	1.10	83	1.8	98	0.099	101	101	12.7	-0.8	398	230	277	275	208	278	1286	320	77	76	76	74	73	-0.063	12.72	2.44
80	12.848	12.966	0.16	0.16	1.33	82	1.86	1.10	84	1.8	97	0.100	101	101	12.0	-0.7	386	230	274	295	209	279	1292	321	76	76	76	74	72	-0.062	12.81	1.93
85	13.652	13.781	0.16	0.16	1.34	83	1.87	1.10	84	1.8	97	0.100	100	100	11.3	-0.7	378	229	274	313	209	281	1306	316	77	76	77	75	73	-0.063	13.07	1.75
90	14.457	14.596	0.16	0.16	1.33	83	1.86	1.10	84	1.9	98	0.099	101	101	10.6	-0.7	378	228	279	326	209	284	1321	322	76	75	77	72	73	-0.063	13.42	1.85
95	15.262	15.412	0.16	0.16	1.34	83	1.86	1.10	84	1.8	98	0.099	101	101	10.0	-0.6	381	228	283	336	209	287	1322	326	76	75	77	71	72	-0.063	12.99	1.25
100	16.068	16.228	0.16	0.16	1.34	83	1.86	1.10	84	1.8	98	0.100	100	101	9.4	-0.6	386	227	284	346	209	290	1319	320	76	74	77	72	73	-0.062	13	1.11
105	16.873	17.043	0.16	0.16	1.34	83	1.86	1.10	84	1.9	98	0.099	101	101	8.8	-0.6	392	226	282	355	210	293	1304	315	76	74	77	72	72	-0.062	12.61	0.93
110	17.678	17.859	0.16	0.16	1.35	83	1.86	1.10	84	1.8	97	0.100	100	101	8.2	-0.6	397	226	281	361	211	295	1285	313	76	74	77	72	72	-0.061	12.39	0.86
115	18.484	18.674	0.16	0.16	1.34	84	1.86	1.10	85	1.9	97	0.098	101	101	7.7	-0.5	400	225	276	367	211	296	1277	308	77	74	77	72	74	-0.060	12.23	0.74
120	19.290	19.490	0.16	0.16	1.33	84	1.86	1.09	85	1.8	97	0.100	100	100	7.2	-0.5	400	226	273	370	213	296	1267	309	77	75	77	73	73	-0.059	11.96	0.69
125	20.096	20.305	0.16	0.16	1.34	84	1.86	1.09	85	1.9	96	0.101	100	100	6.7	-0.5	399	226	270	372	214	296	1262	301	77	75	77	73	73	-0.058	11.86	0.65
130	20.902	21.120	0.16	0.16	1.33	84	1.86	1.10	85	1.8	96	0.099	101	101	6.3	-0.4	401	225	267	373	214	296	1231	303	77	75	77	73	74	-0.058	11.02	0.46
135	21.708	21.936	0.16	0.16	1.34	84	1.86	1.10	85	1.8	95	0.099	101	101	5.9	-0.4	403	225	262	369	214	295	1171	289	77	75	77	73	74	-0.056	10.66	0.38
140	22.514	22.752	0.16	0.16	1.34	84	1.86	1.09	85	1.8	95	0.099	101	101	5.5	-0.4	407	224	254	362	213	292	1137	291	77	75	77	73	73	-0.056	10.64	0.35
145	23.321	23.568	0.16	0.16	1.33	84	1.86	1.10	85	1.8	94	0.100	100	100	5.2	-0.3	413	224	246	354	213	290	1109	285	77	75	77	73	74	-0.055	10.44	0.29
150	24.128	24.384	0.16	0.16	1.34	84	1.86	1.10	85	1.8	93	0.099	100	100	4.8	-0.4	416	224	241	345	214	288	1087	279	77	74	77	73	74	-0.054	10.49	0.33
155	24.934	25.199	0.16	0.16	1.33	84	1.86	1.10	85	1.8	93	0.101	99	99	4.5	-0.3	419	224	235	335	214	285	1064	275	76	74	77	73	73	-0.053	9.99	0.32
160	25.742	26.016	0.16	0.16	1.34	84	1.86	1.10	85	1.8	92	0.102	99	99	4.2	-0.3	424	224	230	324	215	283	1028	270	76	74	77	73	73	-0.052	10.07	0.3
165	26.549	26.832	0.16	0.16	1.34	84	1.85	1.10	85	1.8	92	0.098	101	101	3.9	-0.3	435	224	224	314	218	283	1005	264	76	74	77	73	73	-0.050	9.85	0.33
170	27.356	27.649	0.16	0.16	1.34	84	1.86	1.10	85	1.8	91	0.100	100	100	3.7	-0.2	448	224	218	304	220	283	990	263	76	74	77	73	74	-0.050	9.56	0.35
175	28.164	28.466	0.16	0.16	1.34	85	1.85	1.09	85	1.8	90	0.100	100	100	3.4	-0.3	450	225	214	295	222	281	979	254	76	74	76	73	74	-0.049	9.31	0.39

Wood Heater Test Data - ASTM E2780 / ASTM E2515

Run: 2

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 22-Apr-19
Beginning Clock Time: 11:50

Total Sampling Time: 285 min
Recording Interval: 5 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.022 (1) 0.995 (2) _____ (Amb)

Barometric Pressure:

Begin	Middle	End	Average
30.34	30.32	30.3	30.32 "Hg

OMNI Equipment Numbers: _____

PM Control Modules: 335, 336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.350 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 19.12 ft/sec.
Initial Tunnel Flow: 211.5 scfm
Average Tunnel Flow: 213.8 scfm
Post-Test Leak Check (1): 0.000 cfm @ 6 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 8 in. Hg
Average Test Piece Fuel Moisture: 20.14 Dry Basis %

Technician Signature: _____

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.064	0.096	0.084	0.074	0.064	0.090	0.096	0.068	0.101	"H2O
Temp:	90	90	91	92	94	94	94	94	91	°F

V_{strav} 19.20 ft/sec V_{scent} 21.38 ft/sec F_p 0.898

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)													Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface Temp	Catalyst Exit Temp	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
180	28.972	29.282	0.16	0.16	1.34	85	1.85	1.09	85	1.8	90	0.099	100	100	3.2	-0.2	439	225	209	286	222	276	971	250	76	74	76	73	74	-0.047	9.05	0.42
185	29.779	30.099	0.16	0.16	1.34	85	1.86	1.10	85	1.8	89	0.101	99	99	3.0	-0.2	420	226	205	279	222	270	954	251	76	74	76	73	74	-0.047	8.93	0.38
190	30.587	30.915	0.16	0.16	1.34	85	1.86	1.10	85	1.8	89	0.101	99	99	2.7	-0.3	414	227	201	271	221	267	936	249	76	74	76	73	74	-0.047	9.03	0.31
195	31.394	31.732	0.16	0.16	1.34	85	1.86	1.09	85	1.8	89	0.100	99	100	2.5	-0.2	412	228	198	264	220	264	924	241	76	74	76	73	74	-0.047	8.75	0.34
200	32.202	32.548	0.16	0.16	1.34	85	1.85	1.09	85	1.8	88	0.100	99	100	2.3	-0.2	401	230	195	257	219	260	908	241	76	73	76	73	74	-0.046	8.4	0.34
205	33.010	33.364	0.16	0.16	1.34	85	1.86	1.10	85	1.8	88	0.102	98	99	2.2	-0.1	391	232	192	251	219	257	891	235	76	73	76	73	74	-0.044	8.22	0.33
210	33.818	34.181	0.16	0.16	1.34	85	1.85	1.10	85	1.8	87	0.101	99	99	2.0	-0.2	384	235	188	246	218	254	873	232	75	73	76	73	74	-0.043	8.25	0.33
215	34.627	34.997	0.16	0.16	1.34	85	1.86	1.10	85	1.8	87	0.101	99	99	1.9	-0.1	378	237	184	241	219	252	858	227	75	73	76	73	74	-0.042	8.2	0.34
220	35.435	35.814	0.16	0.16	1.34	85	1.85	1.10	85	1.8	86	0.099	100	100	1.7	-0.2	370	240	181	236	219	249	846	225	75	73	76	73	74	-0.042	8.08	0.35
225	36.243	36.631	0.16	0.16	1.34	85	1.85	1.10	86	1.8	86	0.100	99	99	1.6	-0.1	367	244	178	231	219	248	837	224	75	73	76	72	74	-0.041	8.04	0.36
230	37.052	37.448	0.16	0.16	1.33	85	1.85	1.10	86	1.9	86	0.102	98	98	1.5	-0.1	361	247	176	227	219	246	832	220	75	73	76	72	74	-0.041	8.01	0.38
235	37.861	38.265	0.16	0.16	1.34	85	1.85	1.10	86	1.8	85	0.101	99	99	1.4	-0.1	356	250	173	224	219	244	825	218	75	73	76	72	74	-0.040	7.98	0.4
240	38.669	39.082	0.16	0.16	1.34	85	1.85	1.10	86	1.8	85	0.100	99	99	1.2	-0.2	351	253	172	220	219	243	812	214	75	72	75	72	74	-0.040	8.29	0.34
245	39.478	39.899	0.16	0.16	1.34	85	1.85	1.10	85	1.8	85	0.099	100	100	1.1	-0.1	350	257	170	217	218	242	800	212	75	72	75	72	74	-0.039	8.31	0.33
250	40.287	40.716	0.16	0.16	1.34	85	1.86	1.10	86	1.8	85	0.099	100	100	0.9	-0.2	349	261	168	215	217	242	794	210	75	72	75	72	73	-0.038	8.27	0.35
255	41.096	41.533	0.16	0.16	1.34	85	1.85	1.09	86	1.9	84	0.100	99	99	0.8	-0.1	348	264	166	214	215	241	786	209	75	72	75	72	74	-0.039	8.26	0.36
260	41.905	42.351	0.16	0.16	1.34	85	1.86	1.09	85	1.8	84	0.102	98	98	0.7	-0.1	345	268	165	212	213	241	780	206	75	72	75	72	73	-0.038	8.16	0.35
265	42.714	43.168	0.16	0.16	1.34	85	1.86	1.09	85	1.8	84	0.100	99	99	0.5	-0.2	342	271	164	211	212	240	775	208	74	72	75	72	73	-0.038	7.89	0.35
270	43.523	43.986	0.16	0.16	1.35	85	1.85	1.10	85	1.8	84	0.100	99	99	0.4	-0.1	337	275	162	210	211	239	774	204	74	72	75	72	73	-0.038	8	0.38
275	44.332	44.803	0.16	0.16	1.35	85	1.85	1.09	85	1.8	84	0.100	99	99	0.3	-0.1	335	276	161	209	209	238	762	204	74	72	75	72	73	-0.037	7.22	0.4
280	45.141	45.620	0.16	0.16	1.34	85	1.85	1.10	85	1.8	83	0.102	98	98	0.2	-0.1	334	277	160	208	208	237	750	200	74	72	75	72	73	-0.037	7.18	0.4
285	45.950	46.436	0.16	0.16	1.35	85	1.85	1.10	85	1.8	83	0.102	98	98	0.0	-0.2	332	278	158	207	206	236	739	198	74	72	74	72	73	-0.037	7.14	0.4
Avg/Tot	45.950	46.436	0.16	0.16	1.33	83		1.09	84		92	0.100	100	100								36.4				74	76	72	73	-0.052		

OMNI-Test Laboratories

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Date: 04/22/19
Run: 2
Control #: 0135WS043E
Test Duration: 285
Output Category: 4

Technicians: _____

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	76.8%	83.0%
Combustion Efficiency	94.0%	94.0%
Heat Transfer Efficiency	82%	88.3%

Output Rate (kJ/h)	26,851	25,471	**(Btu/h)**
Burn Rate (kg/h)	1.77	3.89	**(lb/h)**
Input (kJ/h)	34,967	33,170	**(Btu/h)**

Test Load Weight (dry kg)	8.38	18.48	**dry lb**
MC wet (%)	16.76		
MC dry (%)	20.13		
Particulate (g)	12.79		
CO (g)	705		
Test Duration (h)	4.75		

Emissions	**Particulate**	**CO**
g/MJ Output	0.10	5.53
g/kg Dry Fuel	1.53	84.13
g/h	2.69	148.51
lb/MM Btu Output	0.23	12.85

Air/Fuel Ratio (A/F)	10.97

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

VERSION: 2.2 12/14/2009

Manufacturer:	Hearth & Home	**Appliance Type:**	Cat
Model:	Defiant 1975-CAT-C		
Date:	4/22/2019	**Temp. Units**	F (F or C)
Run:	2	**Weight Units**	lb (kg or lb)
Control #:	0135WS043E		
Test Duration:	285		
Output Category:	4		

		Fuel Data	**D. Fir**	
Wood Moisture (% wet):	16.76	**HHV**	19,810	kj/kg
Load Weight (lb wet):	22.20	**%C**	48.73	
Burn Rate (dry kg/h):	1.76	**%H**	6.87	
Total Particulate Emissions:	12.79 g	**%O**	43.9	
		%ASH	0.5	

Averages	**0.72**	**10.40**	**#DIV/0!**	**271.90**	**72.97**	
				Temp. (ºF)		
Elapsed Time (min)	**Fuel Weight Remaining (lb)**	**Flue Gas Composition (%) CO**	**CO_2**	**O_2**	**Flue Gas**	**Room Temp**
0	22.20	0.83	10.57		299.0	73.0
5	21.80	0.13	10.11		257.0	72.0
10	21.40	0.11	10.84		269.0	72.0
15	20.90	0.07	10.49		281.0	71.0
20	20.50	0.07	11.80		290.0	71.0
25	20.00	0.05	11.79		298.0	72.0
30	19.50	0.05	12.13		303.0	71.0
35	18.90	0.08	13.19		318.0	71.0
40	18.30	0.22	13.95		330.0	72.0
45	17.50	0.76	13.60		344.0	71.0
50	16.80	1.16	12.81		336.0	71.0
55	16.00	3.85	12.90		339.0	72.0
60	15.10	3.27	12.82		332.0	72.0
65	14.30	2.78	12.74		322.0	71.0
70	13.50	2.57	12.90		330.0	73.0
75	12.70	2.44	12.72		320.0	73.0
80	12.00	1.93	12.81		321.0	72.0
85	11.30	1.75	13.07		316.0	73.0
90	10.60	1.85	13.42		322.0	73.0
95	10.00	1.25	12.99		326.0	72.0
100	9.40	1.11	13.00		320.0	73.0
105	8.80	0.93	12.61		315.0	72.0

110	8.20	0.86	12.39		313.0	72.0
115	7.70	0.74	12.23		308.0	74.0
120	7.20	0.69	11.96		309.0	73.0
125	6.70	0.65	11.86		301.0	73.0
130	6.30	0.46	11.02		303.0	74.0
135	5.90	0.38	10.66		289.0	74.0
140	5.50	0.35	10.64		291.0	73.0
145	5.20	0.29	10.44		285.0	74.0
150	4.80	0.33	10.49		279.0	74.0
155	4.50	0.32	9.99		275.0	73.0
160	4.20	0.30	10.07		270.0	73.0
165	3.90	0.33	9.85		264.0	73.0
170	3.70	0.35	9.56		263.0	74.0
175	3.40	0.39	9.31		254.0	74.0
180	3.20	0.42	9.05		250.0	74.0
185	3.00	0.38	8.93		251.0	74.0
190	2.70	0.31	9.03		249.0	74.0
195	2.50	0.34	8.75		241.0	74.0
200	2.30	0.34	8.40		241.0	74.0
205	2.20	0.33	8.22		235.0	74.0
210	2.00	0.33	8.25		232.0	74.0
215	1.90	0.34	8.20		227.0	74.0
220	1.70	0.35	8.08		225.0	74.0
225	1.60	0.36	8.04		224.0	74.0
230	1.50	0.38	8.01		220.0	74.0
235	1.40	0.40	7.98		218.0	74.0
240	1.20	0.34	8.29		214.0	74.0
245	1.10	0.33	8.31		212	74
250	0.90	0.35	8.27		210	73
255	0.80	0.36	8.26		209	74
260	0.70	0.35	8.16		206	73
265	0.50	0.35	7.89		208	73
270	0.40	0.38	8		204	73
275	0.30	0.4	7.22		204	73
280	0.20	0.4	7.18		200	73
285	0.00	0.4	7.14		198	73

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 2

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/22/19

Test Crew: B Davis R Tiegs

OMNI Equipment ID numbers:

Wood Heater Run Notes

Air Control Settings

Primary:

Air Control fully open

Secondary: fixed

Tertiary/Pilot: fixed

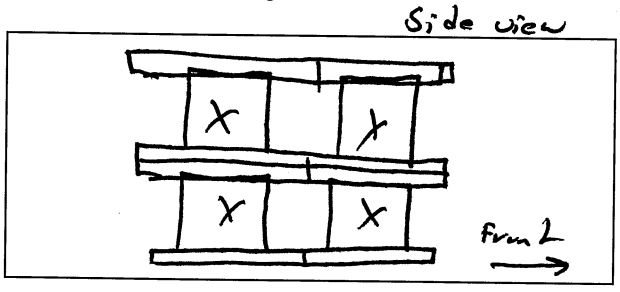
Fan: On High

Preburn Notes

Time	Notes
25	Raked coals
61	Flathead coal bed

Test Notes

Sketch test fuel configuration:



Start up procedures & Timeline:

Bypass: open for 80 seconds then closed

Fuel loaded by: 80 seconds

Door closed at: 80 seconds

Primary air: fully open Entire test

Notes: FAN on high entire test.

Time	Notes
60	Changed front filter on from A.

Technician Signature: BD

Date: 5/7/19

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 2

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/22/19

Test Crew: B Davis R Tiggs

OMNI Equipment ID numbers:

Wood Heater Fuel Data

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

Pre-Burn Fuel

Calibration: Cal Value (1) = 12% Actual Reading 12

Cal Value (2) = 22% Actual Reading 22

Piece:	Length:	Reading:	Piece:	Length:	Reading:
1	70 in	19.2	7	____ in	____
2	70 in	19.6	8	____ in	____
3	70 in	18.8	9	____ in	____
4	96 in	20.1	10	____ in	____
5	____ in	____	11	____ in	____
6	____ in	____	12	____ in	____

Total Pre-Burn Fuel Weight: ~~20.9~~ 29.2 Pre-Burn Fuel Average Moisture: ~~19.42~~

Time (clock): 0858 Room Temperature (F): 69.5 Initials: BD AT

Test Fuel

Firebox Volume (ft³): 3.25 Test Fuel Piece Length (in): 20"

Load Weight Range (lb): ~~22.75~~ 20.5 25.0 Total Wet Fuel Load Weight (lb): 22.2 ~~4.5~~ 6.5

Fuel Type & Amount: 2 x 4: Ø 4 x 4: 4

Weight (with spacers): Ø Weight (with spacers): 22.2

Piece:	Weight (lbs):	Moisture Readings (%DB):			Fuel Type:
1	4.5	19.7	20.6	20.8	4x4
2	5.1	19.2	18.8	19.6	4x4
3	6.0	20.0	19.2	21.4	4x4
4	5.1	21.7	18.4	22.3	4x4
5					
6					
7					

Spacer Moisture Readings (%DB)

9.2	9.4	10.0	8.6				
8.8	9.1	9.0	9.3				
10.0	8.7	8.2	9.4				
8.5	8.9	9.2	8.8				

Time (clock): 915 Room Temperature (F): 69.5 Initials: BD

Technician Signature: Date: 5/7/19

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 2

Model: Defiant 1975CAT-C Tracking Number: 2366 Date: 4/22/19

Test Crew: B Davis R Tiggs

OMNI Equipment ID numbers:

Wood Heater Supplemental Data

Start Time: 11:50 Booth #: E1

Stop Time: 1635

Stack Gas Leak Check:

Initial: good Final: good

Sample Train Leak Check:

A: 0.0 @ 6 "Hg

B: 0.0 @ 8 "Hg

Calibrations: Span Gas CO_2: 10.08 CO: 2.53

	Pre Test		Post Test	
	Zero	Span	Zero	Span
Time	1129	1129	1712	1712
CO_2	0.00	10.08	0.00	10.04
CO	0.000	2.529	-0.001	2.517

Air Velocity (ft/min): Initial: 450 Final: 450

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

Pitot Tube Leak Test: Initial: good Final: good

Stack Diameter (in): 8

Induced Draft: 0.0

% Smoke Capture: 100%

Flue Pipe Cleaned Prior to First Test in Series:

Date: 4/12/19 Initials: BA

	Initial	Middle	Ending
P_b (in/Hg)	30.34		30.30
RH (%)	33.6		30.20
Ambient (°F)	73		73

Tunnel Traverse

Microtector Reading	dP (in H_2O)	T(°F)
	.064	90
	.096	90
	.084	91
	.074	92
	.064	94
	.090	94
	.096	94
	.068	94
Center:		
	.101	91

Tunnel Static Pressure (in H_2O):	
Beginning of Test	End of Test
-.35	-.35

Background Filter Volume: N/A

Technician Signature:

Date: 5/7/19

Run 3

Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Project No.: 0135WS043E
Tracking No.: 2366
Run: 3
Test Date: 4/23/2019

Burn Rate	**0.98 kg/hr dry**
Average Tunnel Temperature	87 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	14.58 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	9839.9 dscf/hour
Average Delta p	0.056 inches H20
Total Time of Test	495 minutes

	AMBIENT	SAMPLE TRAIN 1	SAMPLE TRAIN 2	FIRST HOUR FILTER (TRAIN 1)
Total Sample Volume - Vm	0.000 cubic feet	79.760 cubic feet	79.313 cubic feet	9.589 cubic feet
Average Gas Meter Temperature	73 degrees Fahrenheit	84 degrees Fahrenheit	85 degrees Fahrenheit	83 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	0.000 dscf	80.219 dscf	77.489 dscf	9.659 dscf
Total Particulates - m_n	0 mg	6.4 mg	6.4 mg	1 mg
Particulate Concentration (dry-standard) - C_f/C_s	0.000000 grams/dscf	0.00008 grams/dscf	0.00008 grams/dscf	0.00010 grams/dscf
Total Particulate Emissions - E_T	0.00 grams	6.48 grams	6.70 grams	1.02 grams
Particulate Emission Rate	0.00 grams/hour	0.79 grams/hour	0.81 grams/hour	1.02 grams/hour
Emissions Factor		0.80 g/kg	0.83 g/kg	0.60 g/kg
Difference from Average Total Particulate Emissions		0.11 grams	0.11 grams	

Dual Train Comparison Results Are Acceptable

FINAL AVERAGE RESULTS

Complete Test Run	
Total Particulate Emissions - E_T	6.59 grams
Particulate Emission Rate	**0.80 grams/hour**
Emissions Factor	0.82 grams/kg
First Hour Emissions	
Total Particulate Emissions - E_T	1.02 grams
Particulate Emission Rate	1.02 grams/hour
Emissions Factor	0.60 grams/kg

QUALITY CHECKS

Filter Temps < 90 °F	OK
Filter Face Velocity (47 mm)	OK
Dryer Exit Temp < 80F	OK
Leakage Rate	OK
Ambient Temp (55-90°F)	OK
Negative Probe Weight Eval.	OK
Pro-Rate Variation	OK
Stove Surface ΔT	OK
Train Precision 7.5%	1.73
Train Precision 0.5g/kg	0.03

Technician Signature:_____

Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Project No.: 0135WS043E
Tracking No.: 2366
Run: 3
Test Date: 4/23/2019

	Uncorrected
Burn Rate	**0.98 kg/hr dry**
Average Tunnel Temperature	87 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	14.58 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	9839.9 dscf/hour
Average Delta p	0.056 inches H20
Total Time of Test	495 minutes

	AMBIENT	SAMPLE TRAIN 1	SAMPLE TRAIN 2	FIRST HOUR FILTER (TRAIN 1)
Total Sample Volume - Vm	0.000 cubic feet	79.760 cubic feet	79.313 cubic feet	9.589 cubic feet
Average Gas Meter Temperature	73 degrees Fahrenheit	84 degrees Fahrenheit	85 degrees Fahrenheit	83 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	0.000 dscf	80.219 dscf	77.489 dscf	9.659 dscf
Total Particulates - m_n	0 mg	6.4 mg	6.5 mg	1 mg
Particulate Concentration (dry-standard) - C_f/C_s	0.000000 grams/dscf	0.00008 grams/dscf	0.00008 grams/dscf	0.00010 grams/dscf
Total Particulate Emissions - E_T	0.00 grams	6.48 grams	6.81 grams	1.02 grams
Particulate Emission Rate	0.00 grams/hour	0.79 grams/hour	0.83 grams/hour	1.02 grams/hour
Emissions Factor		0.80 g/kg	0.84 g/kg	0.60 g/kg
Difference from Average Total Particulate Emissions		0.17 grams	0.17 grams	

Dual Train Comparison Results Are Acceptable

FINAL AVERAGE RESULTS

Complete Test Run	
Total Particulate Emissions - E_T	6.64 grams
Particulate Emission Rate	**0.81 grams/hour**
Emissions Factor	0.82 grams/kg
First Hour Emissions	
Total Particulate Emissions - E_T	1.02 grams
Particulate Emission Rate	1.02 grams/hour
Emissions Factor	0.60 grams/kg

QUALITY CHECKS

Filter Temps < 90 °F	OK
Filter Face Velocity (47 mm)	OK
Dryer Exit Temp < 80F	OK
Leakage Rate	OK
Ambient Temp (55-90°F)	OK
Negative Probe Weight Eval.	OK
Pro-Rate Variation	OK
Stove Surface ΔT	OK
Train Precision 7.5%	2.51
Train Precision 0.5g/kg	0.04

Technician Signature:_____

Wood Heater Preburn Data - ASTM E2780

Run:	**3**
Manufacturer:	Hearth & Home
Model:	Defiant 1975-CAT-C
Tracking No.:	2366
Project No.:	0135WS043E
Test Date:	4/23/2019
Beginning Clock Time:	9:18

Coal Bed Range (lb):	**4.2** (min)	**5.3** (max)

Technician Signature: 

			Temperatures (°F)							
Elapsed Time (min)	Scale (lb)	Stack Draft (in H_2O)	FB Top	FB Bottom	FB Back	FB Left	FB Right	Avg. Firebox Surface	Stack	Ambient
0	10.8	-0.063	557	456	171	330	286	360	364	72
5	9.6	-0.055	518	445	176	348	315	360.4	256	71
10	8.8	-0.055	465	427	201	346	318	351.4	249	72
15	7.9	-0.055	413	414	228	337	312	340.8	253	72
20	7.1	-0.054	385	404	251	329	305	334.8	253	72
25	6.2	-0.053	401	397	270	326	300	338.8	282	72
30	5.8	-0.05	400	383	282	324	299	337.6	250	72
35	5.2	-0.052	392	372	294	320	299	335.4	280	72
40	4.9	-0.049	385	359	298	317	302	332.2	242	72
45	4.7	-0.047	372	348	304	314	301	327.8	239	72
50	4.5	-0.043	366	340	306	309	300	324.2	226	71
55	4.4	-0.04	360	334	302	307	299	320.4	212	72
60	4.4	-0.038	356	330	294	304	298	316.4	203	72

Wood Heater Test Fuel Data - ASTM E2780

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 4/23/2019
Run No.: 3

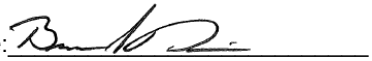
Firebox Volume (ft^3):	3.25
Fuel Piece Length (in):	20
2x4 Crib Weight (lb):	
4x4 Crib Weight (lb):	21.2

Total Fuel Weight (Dry Basis, lb):	17.8	
Fuel Density (lb/ft^3, Dry Basis):	30.06	OK
Loading Density (lb/ft^3, Wet Basis):	6.52	OK
2x4 Percentage:	N/A	N/A

Coal Bed Range (20-25%): **4.24 - 5.3**

Test Fuel Piece	Weight (lb)	Size	Readings (Dry Basis %)			Dry Weight (lb)
1	6	4"x 4"	20.2	19.1	18.7	5.03
2	5.3	4"x 4"	22.0	18.1	22.3	4.39
3	4.5	4"x 4"	19.8	20.0	18.4	3.77
4	4.6	4"x 4"	19.4	19.1	18.8	3.86

Spacer Readings (Dry Basis %)			
9.2	9.3		
9.9	10.2		
9.5	9.8		
9.8			
9.5			
11.3			
12.8			
9.0			
12.1			
9.4			
13.3			
9.9			
10.0			

Technician Signature: 

Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer:	Hearth & Home	Equipment Numbers:	283A, 637, 592
Model:	Defiant 1975-CAT-C		
Tracking No.:	2366		
Project No.:	0135WS043E		
Run #:	3		
Date:	4/23/2019		

TRAIN 1 (First Hour emissions)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	D730	121.9	120.9	1.0
C. Rear filter catch	Filter				0.0
D. Probe catch*	Probe				0.0
E. Filter seals catch*	Seals				0.0

Sub-Total Total Particulate, mg: 1.0

TRAIN 1 (Post First Hour Change-out)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	D731	125.0	121.1	3.9
C. Rear filter catch	Filter	D732	120.7	120.2	0.5
D. Probe catch*	Probe	64	118207.0	118206.6	0.4
E. Filter seals catch*	Seals	R767	3290.0	3289.4	0.6

Sub-Total Total Particulate, mg: 5.4

Train 1 Aggregate Total Particulate, mg: **6.4**

TRAIN 2

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	D733	126.7	122.0	4.7
B. Rear filter catch	Filter	D734	121.9	122.0	-0.1
C. Probe catch*	Probe	65	117084.5	117084.2	0.3
D. Filter seals catch*	Seals	R768	4059.4	4057.9	1.5

Total Particulate, mg: **6.4**

AMBIENT

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

Total Particulate, mg: **0.0**

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

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

Technician Signature: 

Wood Heater Test Data - ASTM E2780 / ASTM E2515

Run: 3

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 4/23/2019
Beginning Clock Time: 10:20

Total Sampling Time: 495 min
Recording Interval: 5 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.022 (1) 0.995 (2) _____ (Amb)

Barometric Pressure:

Begin	Middle	End	Average
30.24	30.24	30.23	30.24 "Hg

OMNI Equipment Numbers: _____

PM Control Modules: 335, 336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.200 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 14.58 ft/sec.
Initial Tunnel Flow: 162.8 scfm
Average Tunnel Flow: 164.0 scfm
Post-Test Leak Check (1): 0.000 cfm @ 5 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 4 in. Hg
Average Test Piece Fuel Moisture: 19.66 Dry Basis %

Technician Signature: _____

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.044	0.056	0.052	0.042	0.036	0.050	0.056	0.038	0.056	"H2O
Temp:	88	88	87	87	87	87	87	87	88	

V_{strav} 14.63 ft/sec V_{scent} 15.90 ft/sec F_p 0.920

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)													Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface Temp	Catalyst Exit Temp	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
0	0.000	0.000			0.07	75	1.71	0.48	76	1.6	130	0.054			21.2		349	328	290	304	299	314	960	245	72	68	72	69	72	-0.041	1.36	0.14
5	0.797	0.784	0.16	0.16	1.34	75	1.84	1.03	76	1.7	90	0.058	99	98	21.0	-0.2	309	321	280	295	292	299	964	213	74	70	74	71	72	-0.043	7.46	0.06
10	1.594	1.570	0.16	0.16	1.34	75	1.82	1.02	77	1.7	88	0.056	100	99	20.8	-0.2	271	313	276	278	276	283	1086	226	74	70	74	69	71	-0.045	8.86	0.29
15	2.390	2.351	0.16	0.16	1.33	76	1.81	1.01	77	1.7	87	0.058	98	97	20.5	-0.3	255	306	283	263	263	274	1103	233	74	70	74	69	72	-0.046	9.21	0.16
20	3.187	3.142	0.16	0.16	1.34	77	1.82	1.05	78	1.7	88	0.057	99	99	20.2	-0.3	241	298	288	251	251	266	1107	236	74	71	74	69	72	-0.046	9.61	0.11
25	3.985	3.940	0.16	0.16	1.34	78	1.83	1.05	79	1.8	88	0.055	101	101	19.9	-0.3	232	292	295	242	242	261	1115	242	74	71	74	70	72	-0.048	9.41	0.05
30	4.786	4.737	0.16	0.16	1.34	78	1.82	1.05	79	1.7	89	0.055	101	101	19.5	-0.4	229	285	298	235	235	256	1134	246	74	72	74	70	72	-0.049	9.83	0.07
35	5.586	5.535	0.16	0.16	1.34	79	1.82	1.05	80	1.8	89	0.056	100	100	19.2	-0.3	232	280	304	230	230	255	1190	250	74	72	74	71	72	-0.050	10.3	0.19
40	6.385	6.333	0.16	0.16	1.34	79	1.83	1.05	81	1.8	91	0.057	99	99	18.8	-0.4	240	275	314	226	227	256	1252	269	74	73	75	71	72	-0.053	10.57	0.28
45	7.186	7.133	0.16	0.16	1.34	80	1.83	1.05	81	1.8	92	0.057	99	100	18.3	-0.5	254	270	325	224	229	260	1267	276	74	73	75	72	71	-0.056	10.35	0.52
50	7.986	7.930	0.16	0.16	1.33	80	1.83	1.06	82	1.8	92	0.056	100	100	17.8	-0.5	276	266	332	224	232	266	1273	281	74	74	75	72	72	-0.054	10.7	0.65
55	8.787	8.730	0.16	0.16	1.34	81	1.83	1.06	82	1.8	93	0.058	98	99	17.3	-0.5	292	263	336	225	236	270	1264	279	74	74	75	73	71	-0.056	10.64	0.7
60	9.589	9.530	0.16	0.16	1.34	81	1.83	1.05	82	1.8	93	0.055	101	101	16.7	-0.6	312	260	335	227	239	275	1263	281	75	74	75	73	72	-0.054	11.02	0.88
65	10.394	10.328	0.16	0.16	1.34	81	1.83	1.05	83	1.8	94	0.057	100	99	16.1	-0.6	323	258	336	230	244	278	1250	280	77	75	75	74	71	-0.055	10.74	1.24
70	11.197	11.127	0.16	0.16	1.34	81	1.82	1.05	83	1.8	94	0.056	100	100	15.6	-0.5	331	256	334	232	248	280	1241	273	76	75	75	74	71	-0.055	10.85	1.18
75	12.000	11.927	0.16	0.16	1.34	82	1.83	1.05	83	1.8	94	0.056	100	100	15.1	-0.5	333	254	332	235	252	281	1243	277	76	75	75	74	72	-0.055	10.75	1.15
80	12.803	12.727	0.16	0.16	1.34	82	1.82	1.05	83	1.8	94	0.054	102	102	14.5	-0.6	335	252	331	237	256	282	1219	270	76	76	75	74	73	-0.055	10.84	0.99
85	13.607	13.526	0.16	0.16	1.34	82	1.82	1.05	83	1.8	94	0.056	100	100	14.0	-0.5	343	250	330	239	260	284	1218	274	76	76	76	74	72	-0.054	10.94	1.02
90	14.411	14.327	0.16	0.16	1.34	82	1.82	1.05	84	1.8	94	0.054	102	102	13.5	-0.5	342	248	329	242	264	285	1233	270	76	76	76	75	72	-0.054	10.92	1.08
95	15.215	15.126	0.16	0.16	1.33	83	1.82	1.05	84	1.8	94	0.056	100	100	12.9	-0.6	350	247	329	243	267	287	1243	271	76	76	76	75	73	-0.053	11.09	1.09
100	16.019	15.927	0.16	0.16	1.34	83	1.82	1.05	84	1.8	94	0.055	101	101	12.4	-0.5	354	245	330	245	271	289	1242	268	76	76	76	75	73	-0.053	11.07	1.03
105	16.823	16.727	0.16	0.16	1.34	83	1.83	1.06	84	1.8	94	0.053	103	103	12.0	-0.4	354	244	330	247	275	290	1237	270	76	76	76	75	72	-0.052	10.97	0.98
110	17.628	17.527	0.16	0.16	1.34	83	1.82	1.05	84	1.8	94	0.054	102	102	11.5	-0.5	358	243	331	249	279	292	1237	268	76	76	76	75	73	-0.053	11.05	1.09
115	18.432	18.329	0.16	0.16	1.34	83	1.82	1.05	84	1.8	94	0.055	101	101	11.0	-0.5	362	242	331	252	283	294	1242	265	76	76	76	75	73	-0.052	11.03	1.22
120	19.238	19.129	0.16	0.16	1.34	83	1.83	1.05	85	1.8	93	0.052	104	104	10.5	-0.5	362	242	332	253	288	295	1233	260	76	76	76	75	72	-0.052	10.9	1
125	20.043	19.930	0.16	0.16	1.34	83	1.82	1.05	85	1.8	93	0.055	101	101	10.1	-0.4	359	242	331	255	291	296	1224	258	76	76	76	76	73	-0.052	11.05	0.99
130	20.848	20.731	0.16	0.16	1.33	84	1.82	1.06	85	1.8	93	0.054	102	102	9.7	-0.4	362	242	329	257	294	297	1220	256	76	76	76	76	72	-0.051	11.03	1.06
135	21.653	21.532	0.16	0.16	1.34	84	1.83	1.05	85	1.8	93	0.055	101	101	9.2	-0.5	366	242	329	258	298	299	1218	252	76	76	76	76	73	-0.050	11.06	0.88
140	22.458	22.333	0.16	0.16	1.34	84	1.82	1.05	85	1.8	93	0.058	98	98	8.9	-0.3	365	241	328	260	302	299	1204	250	76	77	76	76	72	-0.050	10.53	0.7
145	23.263	23.134	0.16	0.16	1.34	84	1.82	1.05	85	1.8	92	0.054	102	102	8.5	-0.4	360	241	326	261	305	299	1193	247	76	76	76	76	73	-0.049	10.26	0.62
150	24.068	23.936	0.16	0.16	1.34	84	1.82	1.05	85	1.8	92	0.055	101	101	8.1	-0.4	356	241	323	262	308	298	1191	246	76	76	76	76	73	-0.049	10.6	0.69
155	24.874	24.736	0.16	0.16	1.34	84	1.82	1.05	85	1.8	92	0.055	101	101	7.8	-0.3	353	240	322	262	311	298	1201	246	76	76	76	76	74	-0.047	10.59	0.77
160	25.679	25.537	0.16	0.16	1.34	84	1.82	1.05	85	1.8	91	0.053	103	103	7.5	-0.3	356	240	321	263	313	299	1187	247	76	76	76	76	74	-0.048	10.36	0.62
165	26.485	26.339	0.16	0.16	1.34	84	1.82	1.05	85	1.8	91	0.055	101	101	7.2	-0.3	355	239	319	264	315	298	1141	237	76	76	76	76	73	-0.047	9.62	0.43
170	27.292	27.140	0.16	0.16	1.33	84	1.82	1.06	86	1.8	91	0.055	101	101	6.9	-0.3	354	238	313	265	316	297	1092	234	76	76	76	76	73	-0.046	9.51	0.35
175	28.098	27.942	0.16	0.16	1.34	84	1.83	1.05	86	1.8	91	0.054	102	102	6.6	-0.3	354	238	307	266	316	296	1062	234	76	75	76	73	74	-0.044	9.46	0.35

Wood Heater Test Data - ASTM E2780 / ASTM E2515

Run: 3

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 4/23/2019
Beginning Clock Time: 10:20

Total Sampling Time: 495 min
Recording Interval: 5 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.022 (1) 0.995 (2) _____ (Amb)

Barometric Pressure:

Begin	Middle	End	Average
30.24	30.24	30.23	30.24 "Hg

OMNI Equipment Numbers: _____

PM Control Modules: 335, 336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.200 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 14.58 ft/sec.
Initial Tunnel Flow: 162.8 scfm
Average Tunnel Flow: 164.0 scfm
Post-Test Leak Check (1): 0.000 cfm @ 5 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 4 in. Hg
Average Test Piece Fuel Moisture: 19.66 Dry Basis %

Technician Signature: _____

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.044	0.056	0.052	0.042	0.036	0.050	0.056	0.038	0.056	"H2O
Temp:	88	88	87	87	87	87	87	87	88	

V_{strav} 14.63 ft/sec V_{scent} 15.90 ft/sec F_p 0.920

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)													Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface Temp	Catalyst Exit Temp	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
180	28.903	28.743	0.16	0.16	1.33	85	1.82	1.05	86	1.8	91	0.054	102	102	6.4	-0.2	357	236	300	266	316	295	1039	227	76	74	76	72	73	-0.044	9.21	0.33
185	29.709	29.544	0.16	0.16	1.33	85	1.82	1.05	86	1.8	90	0.055	101	101	6.1	-0.3	355	236	293	267	315	293	1020	223	76	74	76	72	73	-0.044	8.66	0.33
190	30.515	30.346	0.16	0.16	1.33	85	1.82	1.05	86	1.8	90	0.056	100	100	6.0	-0.1	353	235	288	267	313	291	1006	223	76	74	76	72	74	-0.041	8.7	0.32
195	31.321	31.147	0.16	0.16	1.34	85	1.82	1.06	86	1.8	90	0.056	100	100	5.7	-0.3	352	235	283	268	311	290	996	217	76	74	76	72	74	-0.041	8.8	0.35
200	32.127	31.949	0.16	0.16	1.33	85	1.82	1.05	86	1.8	89	0.054	102	102	5.5	-0.2	352	234	278	268	309	288	998	219	76	74	76	73	74	-0.042	8.79	0.38
205	32.933	32.750	0.16	0.16	1.34	85	1.82	1.05	86	1.8	89	0.054	102	101	5.4	-0.1	351	233	275	269	307	287	991	214	76	74	76	73	74	-0.041	8.09	0.38
210	33.739	33.552	0.16	0.16	1.34	85	1.82	1.05	86	1.8	89	0.055	101	101	5.2	-0.2	351	232	271	269	305	286	974	208	76	74	76	73	74	-0.039	7.9	0.38
215	34.546	34.354	0.16	0.16	1.34	85	1.82	1.05	86	1.8	88	0.054	102	101	5.1	-0.1	353	230	267	270	302	284	960	208	76	74	76	73	73	-0.039	7.78	0.39
220	35.352	35.155	0.16	0.16	1.34	85	1.82	1.05	86	1.8	88	0.053	102	102	4.9	-0.2	355	229	262	270	300	283	949	205	76	74	76	73	74	-0.040	7.7	0.41
225	36.159	35.958	0.16	0.16	1.34	85	1.82	1.06	86	1.8	88	0.054	102	102	4.8	-0.1	357	228	256	271	297	282	957	201	76	74	76	74	74	-0.038	7.67	0.5
230	36.966	36.759	0.16	0.16	1.34	85	1.82	1.05	86	1.8	87	0.054	101	101	4.6	-0.2	350	226	253	271	294	279	960	203	76	74	76	74	74	-0.039	7.47	0.49
235	37.772	37.562	0.16	0.16	1.34	85	1.82	1.05	86	1.8	87	0.053	102	102	4.5	-0.1	346	225	250	270	291	276	948	203	76	74	76	74	74	-0.039	7.34	0.47
240	38.579	38.363	0.16	0.16	1.34	85	1.82	1.06	86	1.8	87	0.055	101	100	4.4	-0.1	344	224	247	270	288	275	932	199	76	74	76	74	74	-0.038	7.23	0.46
245	39.386	39.166	0.16	0.16	1.34	85	1.82	1.05	86	1.8	87	0.055	101	101	4.3	-0.1	341	223	243	269	285	272	917	195	76	74	76	74	74	-0.036	7	0.45
250	40.193	39.967	0.16	0.16	1.33	85	1.82	1.05	86	1.8	87	0.054	101	101	4.2	-0.1	338	221	239	268	282	270	903	195	76	74	76	74	73	-0.035	6.9	0.44
255	41.000	40.770	0.16	0.16	1.34	85	1.83	1.05	86	1.8	87	0.055	101	101	4.1	-0.1	335	220	235	267	278	267	886	194	76	74	76	74	73	-0.036	6.71	0.43
260	41.807	41.571	0.16	0.16	1.34	85	1.82	1.05	86	1.8	87	0.055	101	100	4.0	-0.1	331	219	231	266	275	264	867	189	76	74	76	74	74	-0.034	6.47	0.42
265	42.614	42.373	0.16	0.16	1.34	86	1.82	1.05	86	1.8	86	0.055	100	100	3.9	-0.1	329	217	226	264	272	262	850	189	76	74	76	74	73	-0.034	6.32	0.42
270	43.421	43.176	0.16	0.16	1.34	86	1.82	1.05	86	1.8	86	0.055	100	100	3.8	-0.1	326	216	222	262	269	259	834	189	76	74	76	74	74	-0.035	6.18	0.41
275	44.227	43.977	0.16	0.16	1.33	86	1.82	1.05	86	1.8	85	0.054	101	101	3.8	0	322	214	218	261	266	256	819	185	75	74	76	74	73	-0.034	6.1	0.42
280	45.035	44.780	0.16	0.16	1.33	86	1.82	1.05	86	1.8	86	0.054	101	101	3.7	-0.1	318	213	214	259	263	253	806	187	76	74	76	74	73	-0.032	6.06	0.42
285	45.842	45.581	0.16	0.16	1.33	86	1.82	1.05	86	1.8	85	0.054	101	101	3.6	-0.1	315	212	210	257	261	251	793	184	75	74	76	74	74	-0.032	5.91	0.42
290	46.649	46.384	0.16	0.16	1.33	86	1.82	1.05	86	1.8	85	0.057	98	99	3.6	0	312	210	205	256	258	248	784	183	75	74	76	74	73	-0.032	5.81	0.42
295	47.456	47.186	0.16	0.16	1.33	86	1.82	1.05	86	1.8	85	0.058	98	98	3.5	-0.1	309	209	202	254	255	246	780	182	75	74	75	74	73	-0.032	6.04	0.45
300	48.263	47.989	0.16	0.16	1.34	85	1.82	1.05	86	1.8	85	0.055	100	100	3.4	-0.1	308	208	200	252	252	244	772	180	75	74	75	74	74	-0.032	5.99	0.45
305	49.070	48.790	0.16	0.16	1.34	86	1.82	1.05	86	1.8	85	0.056	99	99	3.3	-0.1	305	207	197	251	249	242	766	184	75	74	75	74	74	-0.032	5.98	0.46
310	49.877	49.593	0.16	0.16	1.34	86	1.82	1.05	86	1.8	85	0.055	100	100	3.3	0	303	205	195	249	247	240	766	179	75	74	75	74	74	-0.031	6.13	0.47
315	50.685	50.396	0.16	0.16	1.34	86	1.82	1.05	86	1.8	85	0.054	101	101	3.2	-0.1	301	203	194	248	245	238	760	181	75	74	75	74	73	-0.032	6	0.46
320	51.492	51.198	0.16	0.16	1.34	86	1.82	1.05	86	1.8	85	0.055	100	100	3.1	-0.1	299	203	192	247	243	237	751	177	75	74	75	74	73	-0.031	5.91	0.46
325	52.299	52.000	0.16	0.16	1.33	86	1.82	1.05	86	1.8	85	0.057	98	98	3.1	0	296	201	190	246	242	235	745	175	75	74	76	74	74	-0.031	5.88	0.46
330	53.106	52.802	0.16	0.16	1.34	86	1.82	1.05	86	1.8	84	0.057	98	98	3.0	-0.1	293	200	189	245	239	233	738	178	75	74	76	74	74	-0.030	5.71	0.46
335	53.913	53.605	0.16	0.16	1.34	86	1.82	1.05	86	1.8	84	0.057	98	99	2.9	-0.1	291	199	187	244	238	232	731	176	75	74	75	74	74	-0.030	5.66	0.46
340	54.720	54.406	0.16	0.16	1.34	86	1.82	1.05	86	1.8	84	0.057	98	98	2.9	0	289	198	185	243	236	230	725	177	75	74	75	74	73	-0.031	5.59	0.46
345	55.528	55.209	0.16	0.16	1.34	86	1.82	1.05	86	1.8	83	0.057	98	98	2.8	-0.1	287	197	184	241	234	229	720	175	75	74	75	74	74	-0.031	5.62	0.47
350	56.334	56.010	0.16	0.16	1.34	86	1.82	1.05	86	1.8	83	0.057	98	98	2.7	-0.1	285	196	182	241	233	227	716	173	75	74	75	74	74	-0.030	5.55	0.46
355	57.142	56.813	0.16	0.16	1.34	86	1.82	1.05	86	1.8	83	0.057	98	98	2.6	-0.1	283	195	180	240	230	226	708	173	75	74	75	74	74	-0.030	5.4	0.46

Wood Heater Test Data - ASTM E2780 / ASTM E2515

Run: 3

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 4/23/2019
Beginning Clock Time: 10:20

Total Sampling Time: 495 min
Recording Interval: 5 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.022 (1) 0.995 (2) _____ (Amb)

Barometric Pressure:

Begin	Middle	End	Average
30.24	30.24	30.23	30.24 "Hg

OMNI Equipment Numbers: _____

PM Control Modules: 335, 336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.200 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 14.58 ft/sec.
Initial Tunnel Flow: 162.8 scfm
Average Tunnel Flow: 164.0 scfm
Post-Test Leak Check (1): 0.000 cfm @ 5 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 4 in. Hg
Average Test Piece Fuel Moisture: 19.66 Dry Basis %

Technician Signature: _____

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.044	0.056	0.052	0.042	0.036	0.050	0.056	0.038	0.056	"H2O
Temp:	88	88	87	87	87	87	87	87	88	

V_{strav} 14.63 ft/sec V_{scent} 15.90 ft/sec F_p 0.920

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)												Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface Temp	Catalyst Exit Temp	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
360	57.949	57.615	0.16	0.16	1.34	86	1.82	1.05	86	1.8	83	0.056	99	99	2.6	0	280	193	180	239	229	224	704	171	75	74	75	74	74	-0.030	5.41	0.46
365	58.757	58.417	0.16	0.16	1.34	86	1.82	1.05	86	1.8	83	0.056	99	99	2.5	-0.1	279	193	178	238	227	223	703	170	75	74	75	74	74	-0.029	5.52	0.49
370	59.564	59.220	0.16	0.16	1.34	85	1.82	1.05	86	1.8	83	0.056	99	99	2.4	-0.1	277	192	178	237	225	222	700	170	75	74	75	74	74	-0.029	5.41	0.49
375	60.372	60.022	0.16	0.16	1.34	85	1.82	1.05	86	1.8	83	0.057	99	98	2.4	0	276	190	177	236	224	221	696	173	75	74	75	74	74	-0.030	5.34	0.48
380	61.179	60.825	0.16	0.16	1.34	85	1.82	1.05	86	1.8	83	0.055	100	100	2.3	-0.1	275	189	176	236	223	220	690	172	75	74	75	74	74	-0.030	5.29	0.48
385	61.987	61.627	0.16	0.16	1.34	85	1.81	1.05	86	1.8	82	0.056	99	99	2.2	-0.1	273	188	175	235	222	219	683	172	75	74	75	74	73	-0.029	5.13	0.47
390	62.794	62.430	0.16	0.16	1.34	85	1.82	1.05	86	1.8	82	0.058	97	97	2.2	0	272	187	174	234	220	217	676	169	75	74	75	74	73	-0.030	5.06	0.48
395	63.602	63.232	0.16	0.16	1.34	85	1.82	1.05	86	1.8	82	0.058	98	97	2.1	-0.1	270	187	174	233	219	217	669	167	75	74	75	74	74	-0.029	4.99	0.47
400	64.410	64.037	0.16	0.16	1.34	85	1.82	1.06	86	1.8	82	0.055	100	100	2.0	-0.1	268	186	172	232	219	215	663	168	75	74	75	73	73	-0.029	4.95	0.47
405	65.218	64.840	0.16	0.16	1.34	85	1.82	1.05	86	1.8	81	0.057	98	98	2.0	0	266	185	172	231	218	214	656	164	75	74	75	73	73	-0.028	4.89	0.47
410	66.026	65.645	0.16	0.16	1.34	85	1.82	1.05	86	1.8	81	0.057	98	98	1.9	-0.1	264	184	171	230	217	213	650	167	74	74	74	73	73	-0.028	4.86	0.46
415	66.834	66.449	0.16	0.16	1.35	85	1.82	1.06	86	1.8	81	0.057	98	98	1.9	0	263	183	169	229	216	212	641	162	74	73	74	73	73	-0.028	4.72	0.46
420	67.642	67.254	0.16	0.16	1.35	85	1.81	1.06	86	1.8	81	0.056	99	99	1.8	-0.1	261	183	167	228	216	211	635	164	74	73	74	73	72	-0.028	4.69	0.46
425	68.450	68.057	0.16	0.16	1.35	85	1.82	1.06	85	1.8	81	0.057	98	98	1.7	-0.1	260	182	167	226	215	210	628	163	74	73	74	73	73	-0.028	4.64	0.45
430	69.258	68.862	0.16	0.16	1.34	85	1.82	1.06	85	1.8	81	0.057	98	99	1.7	0	258	181	165	226	214	209	623	162	74	73	74	73	73	-0.027	4.52	0.45
435	70.066	69.666	0.16	0.16	1.35	85	1.82	1.05	85	1.8	80	0.057	98	98	1.6	-0.1	257	180	165	225	213	208	618	162	74	73	74	73	73	-0.027	4.55	0.46
440	70.874	70.470	0.16	0.16	1.35	85	1.82	1.06	85	1.8	80	0.056	99	99	1.6	0	256	179	162	223	213	207	616	161	74	73	74	73	73	-0.028	4.58	0.46
445	71.682	71.275	0.16	0.16	1.35	84	1.82	1.05	85	1.8	80	0.057	98	99	1.6	0	255	178	162	222	211	206	612	158	74	73	74	73	73	-0.027	4.57	0.46
450	72.490	72.078	0.16	0.16	1.35	84	1.82	1.06	85	1.8	82	0.059	97	97	1.3	-0.3	272	177	161	221	210	208	703	167	74	73	74	73	72	-0.029	9.91	0.45
455	73.297	72.882	0.16	0.16	1.35	84	1.83	1.06	85	1.8	81	0.057	98	99	1.1	-0.2	280	176	165	219	210	210	728	172	74	73	74	72	72	-0.030	9.73	0.34
460	74.105	73.685	0.16	0.16	1.35	84	1.82	1.06	85	1.8	81	0.055	100	100	0.9	-0.2	291	175	170	219	212	213	718	177	74	73	74	72	72	-0.031	9.4	0.25
465	74.913	74.490	0.16	0.16	1.35	84	1.82	1.06	85	1.8	81	0.056	99	100	0.7	-0.2	302	175	175	219	215	217	703	174	74	73	74	72	73	-0.031	8.9	0.18
470	75.720	75.293	0.16	0.16	1.35	84	1.82	1.06	85	1.8	81	0.058	98	98	0.6	-0.1	313	176	178	221	219	221	701	175	74	73	74	72	72	-0.030	8.26	0.21
475	76.528	76.097	0.16	0.16	1.35	84	1.82	1.06	85	1.8	81	0.057	99	99	0.5	-0.1	318	176	180	224	222	224	704	176	74	73	74	72	73	-0.031	8.12	0.2
480	77.336	76.900	0.16	0.16	1.35	84	1.83	1.06	85	1.8	81	0.059	97	97	0.3	-0.2	321	178	182	225	225	226	721	178	73	73	74	72	72	-0.032	7.98	0.24
485	78.144	77.705	0.16	0.16	1.35	84	1.82	1.06	85	1.8	82	0.056	99	100	0.2	-0.1	324	179	184	227	228	228	737	177	73	73	74	72	73	-0.031	7.78	0.27
490	78.952	78.508	0.16	0.16	1.35	84	1.82	1.06	84	1.8	82	0.058	98	98	0.1	-0.1	325	181	186	229	230	230	745	179	73	72	74	72	72	-0.032	7.81	0.28
495	79.760	79.313	0.16	0.16	1.35	84	1.82	1.06	84	1.8	82	0.057	99	99	0.0	-0.1	325	183	189	231	233	232	750	181	73	72	74	72	72	-0.032	7.74	0.31
Avg/Tot	79.760	79.313	0.16	0.16	1.33	84		1.05	85		87	0.056	100	100								81.8				74	75	73	73	-0.039		

OMNI-Test Laboratories

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Date: 04/23/19
Run: 3
Control #: 0135WS043E
Test Duration: 495
Output Category: 2

Technicians:

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	78.8%	85.2%
Combustion Efficiency	95.1%	95.1%
Heat Transfer Efficiency	83%	89.6%

Output Rate (kJ/h)	15,211	14,429	**(Btu/h)**
Burn Rate (kg/h)	0.97	2.15	**(lb/h)**
Input (kJ/h)	19,302	18,310	**(Btu/h)**

Test Load Weight (dry kg)	8.04	17.72	**dry lb**
MC wet (%)	16.43		
MC dry (%)	19.66		
Particulate (g)	6.59		
CO (g)	573		
Test Duration (h)	8.25		

Emissions	**Particulate**	**CO**
g/MJ Output	0.05	4.56
g/kg Dry Fuel	0.82	71.25
g/h	0.80	69.43
lb/MM Btu Output	0.12	10.61

Air/Fuel Ratio (A/F)	14.63

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

VERSION: 2.2 12/14/2009

Manufacturer:	Hearth & Home		**Appliance Type:**	Cat	
Model:	Defiant 1975-CAT-C				
Date:	4/23/2019		**Temp. Units**	F	(F or C)
Run:	3		**Weight Units**	lb	(kg or lb)
Control #:	0135WS043E				
Test Duration:	495				
Output Category:	2		**Fuel Data**		
				D. Fir	
Wood Moisture (% wet):	16.43		**HHV**	19,810	kj/kg
Load Weight (lb wet):	21.20		**%C**	48.73	
Burn Rate (dry kg/h):	0.97		**%H**	6.87	
Total Particulate Emissions:	6.59	g	**%O**	43.9	
			%ASH	0.5	

Averages	**0.51**	**7.84**	**#DIV/0!**	**209.31**	**72.97**	
				Temp. (ºF)	
Elapsed Time (min)	**Fuel Weight Remaining (lb)**	**Flue Gas Composition (%) CO**	**CO_2**	**O_2**	**Flue Gas**	**Room Temp**
0	21.20	0.14	1.36		245	72
5	21.00	0.06	7.46		213	72
10	20.80	0.29	8.86		226	71
15	20.50	0.16	9.21		233	72
20	20.20	0.11	9.61		236	72
25	19.90	0.05	9.41		242	72
30	19.50	0.07	9.83		246	72
35	19.20	0.19	10.30		250	72
40	18.80	0.28	10.57		269	72
45	18.30	0.52	10.35		276	71
50	17.80	0.65	10.70		281	72
55	17.30	0.70	10.64		279	71
60	16.70	0.88	11.02		281	72
65	16.10	1.24	10.74		280	71
70	15.60	1.18	10.85		273	71
75	15.10	1.15	10.75		277	72
80	14.50	0.99	10.84		270	73
85	14.00	1.02	10.94		274	72
90	13.50	1.08	10.92		270	72
95	12.90	1.09	11.09		271	73
100	12.40	1.03	11.07		268	73
105	12.00	0.98	10.97		270	72

110	11.50	1.09	11.05		268	73
115	11.00	1.22	11.03		265	73
120	10.50	1.00	10.90		260	72
125	10.10	0.99	11.05		258	73
130	9.70	1.06	11.03		256	72
135	9.20	0.88	11.06		252	73
140	8.90	0.70	10.53		250	72
145	8.50	0.62	10.26		247	73
150	8.10	0.69	10.60		246	73
155	7.80	0.77	10.59		246	74
160	7.50	0.62	10.36		247	74
165	7.20	0.43	9.62		237	73
170	6.90	0.35	9.51		234	73
175	6.60	0.35	9.46		234	74
180	6.40	0.33	9.21		227	73
185	6.10	0.33	8.66		223	73
190	6.00	0.32	8.70		223	74
195	5.70	0.35	8.80		217	74
200	5.50	0.38	8.79		219	74
205	5.40	0.38	8.09		214	74
210	5.20	0.38	7.90		208	74
215	5.10	0.39	7.78		208	73
220	4.90	0.41	7.70		205	74
225	4.80	0.50	7.67		201	74
230	4.60	0.49	7.47		203	74
235	4.50	0.47	7.34		203	74
240	4.40	0.46	7.23		199	74
245	4.30	0.45	7		195	74
250	4.20	0.44	6.9		195	73
255	4.10	0.43	6.71		194	73
260	4.00	0.42	6.47		189	74
265	3.90	0.42	6.32		189	73
270	3.80	0.41	6.18		189	74
275	3.80	0.42	6.1		185	73
280	3.70	0.42	6.06		187	73
285	3.60	0.42	5.91		184	74
290	3.60	0.42	5.81		183	73
295	3.50	0.45	6.04		182	73
300	3.40	0.45	5.99		180	74
305	3.30	0.46	5.98		184	74
310	3.30	0.47	6.13		179	74
315	3.20	0.46	6		181	73

320	3.10	0.46	5.91		177	73
325	3.10	0.46	5.88		175	74
330	3.00	0.46	5.71		178	74
335	2.90	0.46	5.66		176	74
340	2.90	0.46	5.59		177	73
345	2.80	0.47	5.62		175	74
350	2.70	0.46	5.55		173	74
355	2.60	0.46	5.4		173	74
360	2.60	0.46	5.41		171	74
365	2.50	0.49	5.52		170	74
370	2.40	0.49	5.41		170	74
375	2.40	0.48	5.34		173	74
380	2.30	0.48	5.29		172	74
385	2.20	0.47	5.13		172	73
390	2.20	0.48	5.06		169	73
395	2.10	0.47	4.99		167	74
400	2.00	0.47	4.95		168	73
405	2.00	0.47	4.89		164	73
410	1.90	0.46	4.86		167	73
415	1.90	0.46	4.72		162	73
420	1.80	0.46	4.69		164	72
425	1.70	0.45	4.64		163	73
430	1.70	0.45	4.52		162	73
435	1.60	0.46	4.55		162	73
440	1.60	0.46	4.58		161	73
445	1.60	0.46	4.57		158	73
450	1.30	0.45	9.91		167	72
455	1.10	0.34	9.73		172	72
460	0.90	0.25	9.4		177	72
465	0.70	0.18	8.9		174	73
470	0.60	0.21	8.26		175	72
475	0.50	0.2	8.12		176	73
480	0.30	0.24	7.98		178	72
485	0.20	0.27	7.78		177	73
490	0.10	0.28	7.81		179	72
495	0.00	0.31	7.74		181	72

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 3

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/23/19

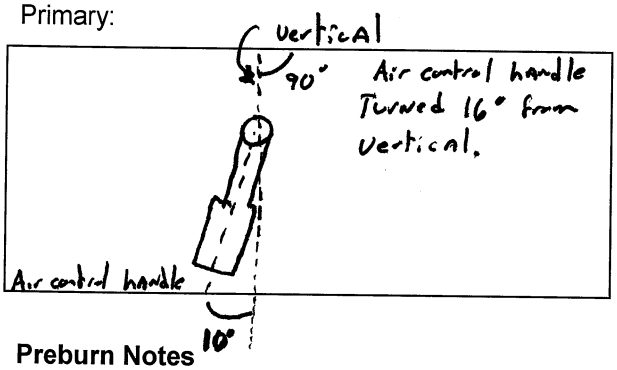
Test Crew: A Adams

OMNI Equipment ID numbers:

Wood Heater Run Notes

Air Control Settings

Primary:



Secondary: fixed

Tertiary/Pilot: N/A

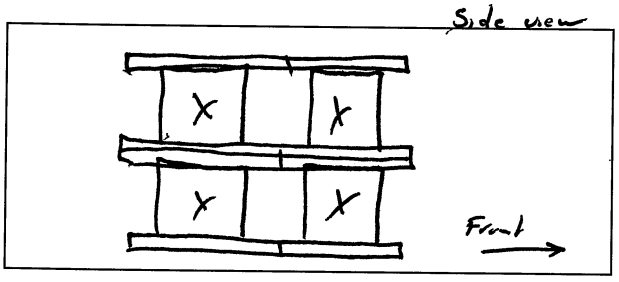
Fan: On Low

Preburn Notes

Time	Notes
22	Raked coals
61	Leveled coal bed

Test Notes

Sketch test fuel configuration:



Start up procedures & Timeline:

Bypass: open with 75 seconds then closed.

Fuel loaded by: 75 seconds

Door closed at: 75 seconds

Primary air: At test setting entire test

Notes: FAN on Low entire test

Time	Notes
60	Changed front filter in train A.
435-445	0 weight loss in 10 min. Moved fuel load pieces in front of Flue exit. Top door and bypass open less than 15 seconds. Front log had been hung up on Firebox.

Technician Signature:

Date: 5/7/19

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets** 3

Client: Hearth & Home Project Number: 0135WS043E Run Number:

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/23/19

Test Crew: Bruce R. Roy

OMNI Equipment ID numbers:

Wood Heater Fuel Data

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

Pre-Burn Fuel

Calibration: Cal Value (1) = 12% Actual Reading 12

Cal Value (2) = 22% Actual Reading 22

Piece:	Length:	Reading:	Piece:	Length:	Reading:
1	96 in	21.6	7	____ in	____
2	96 in	19.8	8	____ in	____
3	72 in	21.1	9	____ in	____
4	48 in	19.4	10	____ in	____
5	____ in	____	11	____ in	____
6	____ in	____	12	____ in	____

Total Pre-Burn Fuel Weight: 29.1 Pre-Burn Fuel Average Moisture: 20.6

Time (clock): 0845 Room Temperature (F): 69.8 Initials: BR

Test Fuel

Firebox Volume (ft³): 3.25 Test Fuel Piece Length (in): 20"

Load Weight Range (lb): 20.5-22.75-25.0 Total Wet Fuel Load Weight (lb): 21.216s

Fuel Type & Amount: 2 x 4: ø 4 x 4: 4

Weight (with spacers): ø Weight (with spacers): 21.2

Piece:	Weight (lbs):	Moisture Readings (%DB):			Fuel Type:
1	6.0	20.2	19.1	18.7	4x4
2	5.3 ~~2.3~~	22	18.1	22.3	↓
3	4.5	19.8	20.0	18.4	↓
4	4.6	19.4	19.1	18.8	↓
5	____	____	____	____	____
6	____	____	____	____	____
7	____	____	____	____	____

Spacer Moisture Readings (%DB)

9.2	9.5	12.1	10.0	____	____	____	____
9.9	11.3	9.4	9.3	____	____	____	____
9.5	12.8	13.7	10.2	____	____	____	____
9.8	9.0	9.9	9.8	____	____	____	____

Time (clock): 0920 Room Temperature (F): 69.8 Initials: BR

Technician Signature: Date: 5/7/19

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 3

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/23/19

Test Crew: B Davis R Tiggs

OMNI Equipment ID numbers:

Wood Heater Supplemental Data

Start Time: 10:20 Booth #: E1

Stop Time: 1835

Stack Gas Leak Check:

Initial: good Final: good

Sample Train Leak Check:

A: 0.0 @ 5 "Hg

B: 0.0 @ 4 "Hg

Calibrations: Span Gas CO_2: 10.08% CO: 2.53%

	Pre Test		Post Test	
	Zero	Span	Zero	Span
Time	0951	9:55	1849	1849
CO_2	0.00	10.02	0.00	10.00
CO	0.000	2.519	-0.001	2.514

Air Velocity (ft/min): Initial: <50 Final: <50

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

Pitot Tube Leak Test: Initial: good Final: good

Stack Diameter (in): 8

Induced Draft: 0.0

% Smoke Capture: 100%

Flue Pipe Cleaned Prior to First Test in Series:

Date: 4/18/19 Initials: BA

	Initial	Middle	Ending
P_b (in/Hg)	30.24		30.23
RH (%)	47.9		41.5
Ambient (°F)	72		72

Tunnel Traverse

Microtector Reading	dP (in H_2O)	T(°F)
	.044	88
	.056	88
	.052	87
	.042	87
	.036	87
	.050	87
	.056	87
	.038	87
Center:		
	.056	88

Background Filter Volume: N/A

Tunnel Static Pressure (in H_2O):	
Beginning of Test	End of Test
-.20	-.20

Technician Signature:

Date: 5/7/19

Run 4

Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Project No.: 0135WS043E
Tracking No.: 2366
Run: 4
Test Date: 4/24/2019

Burn Rate	**0.94 kg/hr dry**
Average Tunnel Temperature	83 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	19.50 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	13286.9 dscf/hour
Average Delta p	0.111 inches H20
Total Time of Test	530 minutes

	AMBIENT	SAMPLE TRAIN 1	SAMPLE TRAIN 2	FIRST HOUR FILTER (TRAIN 1)
Total Sample Volume - Vm	0.000 cubic feet	85.738 cubic feet	85.844 cubic feet	9.543 cubic feet
Average Gas Meter Temperature	72 degrees Fahrenheit	83 degrees Fahrenheit	83 degrees Fahrenheit	82 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	0.000 dscf	86.587 dscf	84.260 dscf	9.660 dscf
Total Particulates - m_n	0 mg	4.4 mg	3.9 mg	0.6 mg
Particulate Concentration (dry-standard) - C_f/C_s	0.000000 grams/dscf	0.00005 grams/dscf	0.00005 grams/dscf	0.00006 grams/dscf
Total Particulate Emissions - E_T	0.00 grams	5.96 grams	5.43 grams	0.83 grams
Particulate Emission Rate	0.00 grams/hour	0.68 grams/hour	0.61 grams/hour	0.83 grams/hour
Emissions Factor		0.72 g/kg	0.65 g/kg	0.48 g/kg
Difference from Average Total Particulate Emissions		0.27 grams	0.27 grams	

Dual Train Comparison Results Are Acceptable

FINAL AVERAGE RESULTS

Complete Test Run	
Total Particulate Emissions - E_T	5.70 grams
Particulate Emission Rate	**0.65 grams/hour**
Emissions Factor	0.69 grams/kg
First Hour Emissions	
Total Particulate Emissions - E_T	0.83 grams
Particulate Emission Rate	0.83 grams/hour
Emissions Factor	0.48 grams/kg

QUALITY CHECKS

Filter Temps < 90 °F	OK
Filter Face Velocity (47 mm)	OK
Dryer Exit Temp < 80F	OK
Leakage Rate	OK
Ambient Temp (55-90°F)	OK
Negative Probe Weight Eval.	OK
Pro-Rate Variation	OK
Stove Surface ΔT	OK
Train Precision 7.5%	4.67
Train Precision 0.5g/kg	0.06

Technician Signature:_____

Wood Heater Preburn Data - ASTM E2780

Run:	**4**
Manufacturer:	Hearth & Home
Model:	Defiant 1975-CAT-C
Tracking No.:	2366
Project No.:	0135WS043E
Test Date:	4/24/2019
Beginning Clock Time:	0935

Coal Bed Range (lb):	**4.4** (min)	**5.5** (max)

Technician Signature: 

			Temperatures (°F)							
Elapsed Time (min)	Scale (lb)	Stack Draft (in H_2O)	FB Top	FB Bottom	FB Back	FB Left	FB Right	Avg. Firebox Surface	Stack	Ambient
0	12	-0.059	645	275	184	394	283	356.2	405	74
5	11.2	-0.048	582	297	197	403	302	356.2	243	74
10	10.6	-0.047	509	308	210	399	307	346.6	232	74
15	10.1	-0.047	474	312	225	393	305	341.8	229	73
20	9.6	-0.047	448	313	243	384	300	337.6	231	72
25	9.1	-0.047	433	312	261	374	296	335.2	234	72
30	8.8	-0.045	414	311	275	366	290	331.2	226	72
35	8	-0.052	415	312	285	362	287	332.2	258	72
40	7.2	-0.052	414	311	306	352	290	334.6	262	72
45	6.5	-0.052	417	309	329	342	295	338.4	265	72
50	5.8	-0.052	435	305	315	314	275	328.8	266	72
55	5	-0.051	450	301	265	288	259	312.6	269	71
60	4.7	-0.049	431	298	240	275	249	298.6	246	71
65	4.5	-0.046	414	293	226	266	239	287.6	234	70
68	4.4	-0.043	400	290	217	260	234	280.2	227	71
68	4.4	-0.043	400	290	217	260	234	280.2	227	71

Wood Heater Test Fuel Data - ASTM E2780

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 4/24/2019
Run No.: 4

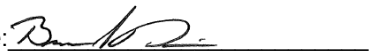
Firebox Volume (ft^3):	3.25
Fuel Piece Length (in):	20
2x4 Crib Weight (lb):	
4x4 Crib Weight (lb):	22

Total Fuel Weight (Dry Basis, lb):	18.3	
Fuel Density (lb/ft^3, Dry Basis):	29.26	OK
Loading Density (lb/ft^3, Wet Basis):	6.77	OK
2x4 Percentage:	N/A	N/A

Coal Bed Range (20-25%): **4.4 - 5.5**

Test Fuel Piece	Weight (lb)	Size	Readings (Dry Basis %)			Dry Weight (lb)
1	4.4	4"x 4"	21.2	22.1	22.1	3.61
2	4.4	4"x 4"	20.4	22.3	21.1	3.63
3	6	4"x 4"	21.2	22.0	20.9	4.94
4	5.3	4"x 4"	20.4	19.1	21.1	4.41

Spacer Readings (Dry Basis %)			
9.0	12.9		
11.4	8.3		
12.5	8.2		
9.0			
7.8			
9.1			
8.5			
12.3			
8.2			
8.1			
9.1			
8.0			
7.3			

Technician Signature: 

Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer:	Hearth & Home	Equipment Numbers:	283A, 637, 592
Model:	Defiant 1975-CAT-C		
Tracking No.:	2366		
Project No.:	0135WS043E		
Run #:	4		
Date:	4/24/2019		

TRAIN 1 (First Hour emissions)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	D735	121.4	120.8	0.6
C. Rear filter catch	Filter				0.0
D. Probe catch*	Probe				0.0
E. Filter seals catch*	Seals				0.0

Sub-Total Total Particulate, mg: 0.6

TRAIN 1 (Post First Hour Change-out)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	D736	123.1	120.6	2.5
C. Rear filter catch	Filter	D737	121.9	121.5	0.4
D. Probe catch*	Probe	66	118455.4	118454.9	0.5
E. Filter seals catch*	Seals	R769	3283.7	3283.3	0.4

Sub-Total Total Particulate, mg: 3.8

Train 1 Aggregate Total Particulate, mg: **4.4**

TRAIN 2

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	D738	124.4	121.2	3.2
B. Rear filter catch	Filter	D739	120.0	119.7	0.3
C. Probe catch*	Probe	67	117759.5	117759.5	0.0
D. Filter seals catch*	Seals	R770	3550.1	3549.7	0.4

Total Particulate, mg: **3.9**

AMBIENT

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

Total Particulate, mg: **0.0**

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

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

Technician Signature: 

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - ASTM E2780 / ASTM E2515

Run: 4

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 4/24/2019
Beginning Clock Time: 10:46:00 AM

Total Sampling Time: 530 min
Recording Interval: 5 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.022 (1) 0.995 (2) _____ (Amb)

Barometric Pressure: Begin 30.38 Middle 30.31 End 30.24 Average 30.31 "Hg

OMNI Equipment Numbers: _____

PM Control Modules: 335, 336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.400 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 19.50 ft/sec.
Initial Tunnel Flow: 218.8 scfm
Average Tunnel Flow: 221.4 scfm
Post-Test Leak Check (1): 0.000 cfm @ 6 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 4 in. Hg
Average Test Piece Fuel Moisture: 21.16 Dry Basis %

Technician Signature: _____

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.064	0.096	0.104	0.068	0.074	0.108	0.094	0.074	0.114	"H2O
Temp:	92	92	92	92	92	92	92	92	92	

V_{strav} 19.91 ft/sec V_{scent} 22.72 ft/sec F_p 0.876

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)													Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface Temp	Catalyst Exit Temp	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
0	0.000	0.000			0.65	74	1.18	0.66	76	1.8	118	0.111			22.0		386	289	213	260	233	276	937	245	69	66	70	67	71	-0.043	2.03	0.13
5	0.792	0.811	0.16	0.16	1.33	74	1.78	1.10	76	1.8	86	0.111	100	102	21.7	-0.3	331	285	205	244	223	258	1087	224	71	69	72	69	70	-0.049	8.86	0.64
10	1.583	1.623	0.16	0.16	1.31	74	1.78	1.10	76	1.8	84	0.113	99	101	21.4	-0.3	290	282	209	222	206	242	1111	229	71	68	72	68	69	-0.048	9.07	0.39
15	2.377	2.433	0.16	0.16	1.34	75	1.79	1.09	76	1.8	84	0.112	99	101	21.1	-0.3	268	277	216	204	193	232	1134	233	72	68	72	67	70	-0.049	9.55	0.43
20	3.173	3.240	0.16	0.16	1.33	76	1.79	1.08	77	1.8	84	0.113	99	100	20.8	-0.3	248	272	222	191	182	223	1166	240	72	68	72	67	69	-0.050	10.2	0.38
25	3.968	4.047	0.16	0.16	1.34	76	1.79	1.09	77	1.8	85	0.113	99	100	20.4	-0.4	236	268	229	181	175	218	1200	246	72	68	72	67	70	-0.050	10.64	0.34
30	4.764	4.854	0.16	0.16	1.33	77	1.79	1.09	78	1.8	86	0.113	99	100	20.0	-0.4	232	264	237	174	171	216	1216	250	72	69	72	67	69	-0.051	10.82	0.26
35	5.560	5.661	0.16	0.16	1.34	77	1.79	1.08	78	1.8	87	0.111	100	101	19.6	-0.4	232	260	243	169	168	214	1235	257	72	69	72	67	69	-0.051	11.06	0.14
40	6.357	6.468	0.16	0.16	1.33	78	1.79	1.08	79	1.8	89	0.111	100	101	19.2	-0.4	230	256	248	166	166	213	1230	258	72	69	72	68	70	-0.051	10.84	0.07
45	7.153	7.276	0.16	0.16	1.33	78	1.8	1.08	79	1.8	90	0.113	99	100	18.7	-0.5	232	253	251	163	167	213	1243	261	73	69	73	68	71	-0.051	11.07	0.06
50	7.950	8.082	0.16	0.16	1.32	79	1.8	1.08	80	1.8	90	0.112	99	100	18.3	-0.4	240	250	255	162	168	215	1253	268	73	69	73	68	71	-0.052	11.36	0.07
55	8.745	8.889	0.16	0.16	1.33	79	1.8	1.08	80	1.8	91	0.111	100	101	17.8	-0.5	243	248	257	162	170	216	1251	263	73	70	73	68	72	-0.052	11.15	0.06
60	9.543	9.697	0.16	0.16	1.32	80	1.8	1.08	81	1.8	92	0.112	99	101	17.4	-0.4	256	246	259	162	171	219	1304	275	74	70	74	69	71	-0.056	12.03	0.39
65	10.346	10.504	0.16	0.16	1.36	80	1.84	1.08	81	1.8	93	0.111	101	101	16.8	-0.6	275	244	266	163	174	224	1306	279	76	70	74	69	72	-0.054	11.75	0.21
70	11.153	11.312	0.16	0.16	1.36	81	1.84	1.08	82	1.8	92	0.112	100	100	16.3	-0.5	283	243	267	166	178	227	1288	277	76	70	74	69	72	-0.055	11.37	0.19
75	11.960	12.121	0.16	0.16	1.35	81	1.84	1.08	82	1.8	91	0.109	102	102	15.8	-0.5	291	241	266	167	181	229	1299	278	75	71	75	70	72	-0.055	11.73	0.28
80	12.768	12.929	0.16	0.16	1.36	82	1.84	1.08	82	1.8	91	0.111	101	101	15.3	-0.5	297	240	267	169	184	231	1287	276	75	71	75	70	71	-0.054	11.5	0.27
85	13.576	13.737	0.16	0.16	1.36	82	1.84	1.08	83	1.8	90	0.110	101	101	14.9	-0.4	301	239	265	171	187	233	1289	278	75	71	75	70	72	-0.054	11.5	0.26
90	14.385	14.546	0.16	0.16	1.36	82	1.84	1.08	83	1.8	90	0.113	100	100	14.4	-0.5	306	238	265	173	190	234	1280	270	75	72	75	70	73	-0.053	11.74	0.22
95	15.194	15.356	0.16	0.16	1.36	82	1.84	1.08	83	1.8	90	0.112	100	100	13.8	-0.6	311	237	264	174	193	236	1293	271	75	72	75	71	72	-0.054	11.65	0.45
100	16.003	16.165	0.16	0.16	1.36	83	1.84	1.08	83	1.8	90	0.111	101	101	13.4	-0.4	319	236	265	176	197	239	1303	271	75	72	75	71	71	-0.053	11.8	0.56
105	16.813	16.974	0.16	0.16	1.35	83	1.84	1.08	83	1.8	90	0.110	101	101	12.9	-0.5	330	235	266	178	200	242	1307	270	75	72	75	71	71	-0.053	11.86	0.68
110	17.622	17.783	0.16	0.16	1.35	83	1.84	1.08	84	1.8	90	0.109	101	101	12.4	-0.5	339	234	266	180	204	245	1297	272	75	72	75	71	72	-0.053	11.51	0.87
115	18.432	18.594	0.16	0.16	1.36	83	1.84	1.08	84	1.8	89	0.112	100	100	11.9	-0.5	346	233	265	183	209	247	1276	264	75	72	74	71	72	-0.053	11.23	0.95
120	19.242	19.403	0.16	0.16	1.36	83	1.84	1.08	84	1.8	88	0.113	100	99	11.5	-0.4	356	233	260	185	213	249	1236	257	75	72	74	71	72	-0.052	10.63	0.76
125	20.052	20.212	0.16	0.16	1.36	83	1.84	1.08	84	1.8	88	0.112	100	100	11.1	-0.4	355	232	253	187	216	249	1205	252	75	72	74	71	72	-0.050	10.49	0.71
130	20.861	21.022	0.16	0.16	1.37	83	1.84	1.09	84	1.8	87	0.109	101	101	10.7	-0.4	357	232	246	188	219	248	1179	248	75	72	74	71	72	-0.049	10.4	0.65
135	21.671	21.832	0.16	0.16	1.36	83	1.84	1.09	84	1.8	87	0.111	100	100	10.2	-0.5	361	231	240	189	221	248	1169	245	74	72	74	71	72	-0.049	10.57	0.7
140	22.482	22.642	0.16	0.16	1.37	83	1.84	1.08	84	1.8	86	0.111	100	100	9.9	-0.3	360	231	235	189	223	248	1147	242	74	72	74	71	72	-0.048	10.12	0.54
145	23.293	23.452	0.16	0.16	1.36	83	1.84	1.08	84	1.8	86	0.111	100	100	9.5	-0.4	360	231	231	190	225	247	1109	237	74	72	74	71	72	-0.047	9.86	0.43
150	24.104	24.262	0.16	0.16	1.35	83	1.85	1.08	84	1.8	86	0.109	101	101	9.2	-0.3	362	230	227	190	227	247	1087	232	74	72	74	71	71	-0.047	9.37	0.42
155	24.915	25.073	0.16	0.16	1.35	83	1.84	1.08	84	1.8	85	0.111	100	100	8.9	-0.3	356	229	221	190	228	245	1060	230	74	72	74	71	71	-0.045	8.94	0.36
160	25.726	25.884	0.16	0.16	1.37	83	1.84	1.08	84	1.8	84	0.110	101	101	8.7	-0.2	353	228	215	190	228	243	1026	223	74	72	74	71	72	-0.044	8.99	0.31
165	26.537	26.694	0.16	0.16	1.36	83	1.84	1.08	84	1.8	84	0.111	100	100	8.5	-0.2	350	227	209	189	228	241	1016	219	74	72	74	71	71	-0.043	8.81	0.34
170	27.347	27.503	0.16	0.16	1.37	83	1.84	1.08	84	1.8	84	0.110	101	100	8.2	-0.3	346	226	205	189	227	239	996	216	74	71	74	71	71	-0.042	8.85	0.25
175	28.158	28.314	0.16	0.16	1.37	83	1.84	1.08	84	1.8	84	0.110	101	101	8.0	-0.2	342	226	202	188	225	237	1003	212	74	71	74	71	72	-0.042	8.64	0.35
180	28.970	29.124	0.16	0.16	1.36	83	1.84	1.08	84	1.8	83	0.112	100	99	7.8	-0.2	342	225	199	187	223	235	997	213	74	71	74	71	72	-0.041	8.64	0.36
185	29.781	29.935	0.16	0.16	1.36	83	1.84	1.08	84	1.8	84	0.111	100	100	7.5	-0.3	336	224	199	187	223	234	1087	223	74	71	74	71	72	-0.043	8.69	0.73
190	30.592	30.745	0.16	0.16	1.36	83	1.84	1.07	84	1.8	84	0.111	100	100	7.3	-0.2	337	223	202	187	221	234	1106	221	74	71	74	71	72	-0.044	8.86	0.77

Wood Heater Test Data - ASTM E2780 / ASTM E2515

Run: 4

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 4/24/2019
Beginning Clock Time: 10:46:00 AM

Total Sampling Time: 530 min
Recording Interval: 5 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.022 (1) 0.995 (2) _____ (Amb)

Barometric Pressure:	Begin	Middle	End	Average
	30.38	30.31	30.24	30.31 "Hg

OMNI Equipment Numbers: _____

PM Control Modules: 335, 336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.400 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 19.50 ft/sec.
Initial Tunnel Flow: 218.8 scfm
Average Tunnel Flow: 221.4 scfm
Post-Test Leak Check (1): 0.000 cfm @ 6 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 4 in. Hg
Average Test Piece Fuel Moisture: 21.16 Dry Basis %

Technician Signature: _____

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.064	0.096	0.104	0.068	0.074	0.108	0.094	0.074	0.114	"H2O
Temp:	92	92	92	92	92	92	92	92	92	

V_{strav} 19.91 ft/sec V_{scent} 22.72 ft/sec F_p 0.876

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)													Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface Temp	Catalyst Exit Temp	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
195	31.403	31.555	0.16	0.16	1.36	83	1.84	1.08	84	1.8	84	0.111	100	100	7.0	-0.3	338	222	204	187	220	234	1077	220	74	71	74	71	71	-0.042	8.65	0.72
200	32.214	32.365	0.16	0.16	1.37	83	1.84	1.08	84	1.8	84	0.112	100	99	6.8	-0.2	336	221	203	187	219	233	1097	221	74	71	74	71	72	-0.043	8.73	0.76
205	33.024	33.176	0.16	0.16	1.37	83	1.85	1.08	84	1.8	84	0.111	100	100	6.6	-0.2	333	220	203	187	218	232	1090	219	74	71	74	71	72	-0.043	8.77	0.76
210	33.836	33.987	0.16	0.16	1.36	83	1.84	1.08	84	1.8	84	0.111	100	100	6.4	-0.2	333	219	201	187	217	231	1077	218	74	71	74	70	72	-0.042	8.56	0.74
215	34.646	34.797	0.16	0.16	1.36	83	1.84	1.08	84	1.8	84	0.111	100	100	6.1	-0.3	331	218	200	187	216	230	1078	215	74	71	74	70	72	-0.042	8.62	0.74
220	35.457	35.607	0.16	0.16	1.36	83	1.84	1.08	84	1.8	83	0.112	100	99	5.9	-0.2	330	217	199	187	215	230	1070	219	74	71	74	70	72	-0.041	8.51	0.72
225	36.269	36.417	0.16	0.16	1.35	83	1.84	1.08	84	1.8	83	0.111	100	100	5.7	-0.2	332	216	198	187	213	229	1023	214	74	71	74	70	73	-0.041	8.1	0.63
230	37.079	37.228	0.16	0.16	1.36	83	1.84	1.08	84	1.8	83	0.111	100	100	5.5	-0.2	334	215	193	187	212	228	985	209	74	71	74	70	72	-0.040	8.04	0.43
235	37.890	38.038	0.16	0.16	1.36	83	1.84	1.07	84	1.8	83	0.110	101	100	5.4	-0.1	333	214	188	187	211	227	948	203	74	70	74	70	72	-0.039	7.85	0.42
240	38.700	38.847	0.16	0.16	1.36	83	1.84	1.08	84	1.8	82	0.110	100	100	5.2	-0.2	334	214	182	187	209	225	932	199	74	70	74	70	73	-0.038	7.72	0.44
245	39.510	39.657	0.16	0.16	1.36	83	1.84	1.08	84	1.8	82	0.112	99	99	5.1	-0.1	334	213	178	186	207	224	925	198	74	70	74	70	72	-0.037	7.64	0.47
250	40.321	40.467	0.16	0.16	1.36	83	1.84	1.08	84	1.8	82	0.111	100	100	4.9	-0.2	330	212	175	186	206	222	913	194	74	70	74	70	73	-0.036	7.36	0.44
255	41.131	41.279	0.16	0.16	1.36	83	1.84	1.08	84	1.8	82	0.109	101	101	4.8	-0.1	328	212	172	185	204	220	904	195	74	70	73	70	73	-0.036	7.22	0.44
260	41.942	42.088	0.16	0.16	1.36	83	1.84	1.08	84	1.8	82	0.112	100	99	4.7	-0.1	328	211	169	184	202	219	907	193	74	70	74	70	73	-0.036	7.19	0.45
265	42.753	42.898	0.16	0.16	1.35	83	1.84	1.08	84	1.8	81	0.111	100	100	4.5	-0.2	322	210	168	184	199	217	916	190	74	70	74	70	73	-0.036	7.16	0.53
270	43.565	43.708	0.16	0.16	1.36	84	1.84	1.08	84	1.8	81	0.110	100	100	4.4	-0.1	321	209	167	183	198	216	894	188	74	70	74	70	73	-0.035	6.99	0.48
275	44.376	44.519	0.16	0.16	1.36	84	1.85	1.08	84	1.8	81	0.112	99	99	4.3	-0.1	319	208	165	182	195	214	894	188	74	70	74	70	72	-0.035	7	0.52
280	45.186	45.330	0.16	0.16	1.36	84	1.84	1.08	84	1.8	81	0.110	100	100	4.2	-0.1	316	207	164	181	194	212	888	186	74	70	74	70	73	-0.034	6.76	0.51
285	45.997	46.140	0.16	0.16	1.36	84	1.84	1.07	84	1.8	81	0.111	100	100	4.1	-0.1	314	206	162	180	192	211	875	192	74	70	74	70	73	-0.035	6.65	0.5
290	46.808	46.950	0.16	0.16	1.36	84	1.84	1.08	84	1.8	81	0.110	100	100	4.0	-0.1	310	205	160	179	190	209	864	185	74	70	74	70	73	-0.034	6.51	0.49
295	47.618	47.760	0.16	0.16	1.35	84	1.84	1.08	84	1.8	81	0.110	100	100	3.9	-0.1	308	204	158	178	188	207	862	185	74	70	74	70	73	-0.034	7.11	0.5
300	48.429	48.571	0.16	0.16	1.36	84	1.83	1.08	84	1.8	81	0.111	100	100	3.8	-0.1	306	203	157	177	187	206	847	184	74	70	74	70	73	-0.033	6.86	0.47
305	49.240	49.381	0.16	0.16	1.35	84	1.84	1.08	84	1.8	81	0.111	100	100	3.7	-0.1	303	202	155	176	185	204	841	185	74	70	74	70	73	-0.034	6.64	0.47
310	50.051	50.191	0.16	0.16	1.35	84	1.84	1.08	84	1.8	81	0.111	100	100	3.6	-0.1	301	201	154	175	184	203	832	184	74	70	74	70	73	-0.033	6.57	0.46
315	50.862	51.001	0.16	0.16	1.36	84	1.84	1.08	84	1.8	81	0.111	100	100	3.5	-0.1	298	201	152	174	182	201	822	180	74	70	74	70	73	-0.033	6.48	0.46
320	51.672	51.811	0.16	0.16	1.36	84	1.83	1.08	84	1.8	81	0.111	100	100	3.4	-0.1	294	200	151	174	180	200	810	181	74	70	74	70	73	-0.033	6.27	0.46
325	52.482	52.622	0.16	0.16	1.36	84	1.84	1.07	84	1.8	81	0.111	100	100	3.3	-0.1	291	199	149	174	179	198	801	181	74	70	74	70	73	-0.033	6.16	0.47
330	53.293	53.432	0.16	0.16	1.36	84	1.83	1.07	84	1.8	81	0.111	100	100	3.3	0	288	198	147	174	177	197	795	177	74	70	74	70	73	-0.033	6.41	0.49
335	54.105	54.242	0.16	0.16	1.35	84	1.84	1.08	84	1.8	81	0.111	100	100	3.2	-0.1	284	198	147	174	175	196	806	180	74	70	74	70	73	-0.033	6.51	0.49
340	54.916	55.052	0.16	0.16	1.35	84	1.84	1.08	84	1.8	81	0.110	100	100	3.1	-0.1	281	198	146	175	173	195	800	180	74	70	74	70	73	-0.033	6.5	0.48
345	55.727	55.862	0.16	0.16	1.36	84	1.84	1.08	84	1.8	81	0.111	100	100	3.0	-0.1	279	197	145	175	171	193	783	175	74	70	74	70	73	-0.032	6.3	0.45
350	56.539	56.673	0.16	0.16	1.35	84	1.84	1.08	84	1.8	80	0.112	99	99	2.9	-0.1	277	196	144	175	169	192	774	175	74	70	74	70	73	-0.031	6.49	0.43
355	57.349	57.483	0.16	0.16	1.36	84	1.84	1.07	84	1.8	80	0.110	100	100	2.8	-0.1	279	196	143	176	168	192	740	172	74	70	74	70	73	-0.031	6.9	0.39

Wood Heater Test Data - ASTM E2780 / ASTM E2515

Run: 4

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 4/24/2019
Beginning Clock Time: 10:46:00 AM

Total Sampling Time: 530 min
Recording Interval: 5 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.022 (1) 0.995 (2) _____ (Amb)

Barometric Pressure: Begin 30.38 Middle 30.31 End 30.24 Average 30.31 "Hg

OMNI Equipment Numbers: _____

PM Control Modules: 335, 336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.400 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 19.50 ft/sec.
Initial Tunnel Flow: 218.8 scfm
Average Tunnel Flow: 221.4 scfm
Post-Test Leak Check (1): 0.000 cfm @ 6 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 4 in. Hg
Average Test Piece Fuel Moisture: 21.16 Dry Basis %

Technician Signature: _____

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.064	0.096	0.104	0.068	0.074	0.108	0.094	0.074	0.114	"H2O
Temp:	92	92	92	92	92	92	92	92	92	

V_{strav} 19.91 ft/sec V_{scent} 22.72 ft/sec F_p 0.876

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)												Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface Temp	Catalyst Exit Temp	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
360	58.160	58.293	0.16	0.16	1.36	84	1.84	1.07	84	1.8	80	0.111	100	100	2.7	-0.1	283	196	141	176	168	193	725	170	74	70	74	70	73	-0.030	6.64	0.38
365	58.971	59.103	0.16	0.16	1.36	84	1.84	1.08	84	1.8	80	0.112	99	99	2.6	-0.1	283	196	139	176	168	192	722	168	74	70	74	70	73	-0.029	6.65	0.4
370	59.782	59.914	0.16	0.16	1.35	84	1.84	1.08	84	1.8	80	0.110	100	100	2.5	-0.1	283	195	138	175	168	192	725	168	74	70	74	70	73	-0.030	6.31	0.42
375	60.593	60.725	0.16	0.16	1.35	84	1.84	1.08	84	1.8	80	0.109	101	101	2.4	-0.1	280	195	137	175	167	191	734	169	74	70	74	70	73	-0.030	6.11	0.45
380	61.405	61.534	0.16	0.16	1.35	84	1.84	1.07	85	1.8	80	0.112	99	99	2.3	-0.1	276	195	137	174	167	190	762	170	74	70	74	70	73	-0.030	6.09	0.54
385	62.216	62.345	0.16	0.16	1.36	84	1.84	1.08	84	1.8	80	0.110	100	100	2.3	0	272	195	138	174	165	189	772	173	74	70	74	70	73	-0.030	6.13	0.53
390	63.026	63.155	0.16	0.16	1.35	84	1.84	1.08	85	1.8	80	0.111	100	99	2.2	-0.1	269	195	139	174	164	188	772	173	74	70	74	70	73	-0.031	6.14	0.54
395	63.837	63.966	0.16	0.16	1.36	84	1.84	1.08	85	1.8	80	0.110	100	100	2.1	-0.1	267	195	139	173	163	187	768	173	74	70	74	70	73	-0.030	6.02	0.53
400	64.648	64.776	0.16	0.16	1.36	84	1.84	1.08	85	1.8	80	0.110	100	100	2.0	-0.1	267	194	139	174	162	187	738	174	74	70	74	70	73	-0.030	6.07	0.4
405	65.460	65.586	0.16	0.16	1.35	84	1.84	1.07	85	1.8	80	0.111	100	99	1.9	-0.1	269	194	138	175	161	187	714	167	74	70	74	70	73	-0.028	5.99	0.41
410	66.271	66.396	0.16	0.16	1.35	84	1.84	1.08	85	1.8	80	0.110	100	100	1.8	-0.1	269	193	136	175	160	187	711	166	74	70	74	70	74	-0.029	6.04	0.44
415	67.082	67.207	0.16	0.16	1.35	84	1.84	1.08	85	1.8	80	0.111	100	99	1.7	-0.1	267	193	135	176	159	186	718	166	74	70	74	70	73	-0.030	5.98	0.46
420	67.893	68.018	0.16	0.16	1.36	85	1.83	1.07	85	1.8	80	0.109	100	100	1.6	-0.1	267	193	134	176	158	186	705	163	74	70	74	70	74	-0.029	5.97	0.44
425	68.704	68.828	0.16	0.16	1.35	85	1.83	1.07	85	1.8	80	0.109	100	100	1.6	0	265	193	134	176	157	185	709	165	74	70	74	70	74	-0.029	5.79	0.46
430	69.514	69.637	0.16	0.16	1.36	85	1.83	1.08	85	1.8	80	0.110	100	100	1.5	-0.1	263	192	134	176	156	184	704	163	74	70	74	70	74	-0.029	5.87	0.44
435	70.325	70.447	0.16	0.16	1.36	85	1.84	1.08	85	1.8	80	0.109	100	100	1.4	-0.1	262	192	133	177	155	184	698	166	74	70	74	70	74	-0.029	5.68	0.44
440	71.136	71.258	0.16	0.16	1.36	85	1.84	1.07	85	1.8	79	0.112	99	99	1.3	-0.1	259	192	132	177	154	183	715	166	74	70	74	70	74	-0.029	5.49	0.51
445	71.947	72.069	0.16	0.16	1.35	85	1.83	1.07	85	1.8	80	0.111	100	99	1.2	-0.1	256	192	133	177	153	182	718	167	74	70	74	70	74	-0.029	5.59	0.54
450	72.759	72.879	0.16	0.16	1.34	85	1.84	1.07	85	1.8	80	0.111	100	99	1.2	0	255	191	133	177	152	182	713	168	74	70	74	70	74	-0.030	5.35	0.52
455	73.570	73.689	0.16	0.16	1.35	85	1.84	1.07	85	1.8	80	0.110	100	100	1.1	-0.1	253	190	133	177	151	181	704	168	74	70	74	70	74	-0.030	5.17	0.51
460	74.381	74.499	0.16	0.16	1.35	85	1.84	1.07	85	1.8	80	0.111	100	99	1.0	-0.1	251	189	132	178	150	180	696	164	74	70	74	70	74	-0.029	5.08	0.52
465	75.191	75.309	0.16	0.16	1.36	85	1.84	1.08	85	1.8	79	0.110	100	100	0.9	-0.1	249	188	132	178	149	179	688	165	74	70	74	70	74	-0.029	5.01	0.52
470	76.002	76.119	0.16	0.16	1.36	85	1.83	1.07	85	1.8	79	0.113	99	98	0.8	-0.1	248	187	131	179	148	179	686	164	74	70	74	70	74	-0.029	5.2	0.54
475	76.814	76.929	0.16	0.16	1.35	85	1.84	1.07	85	1.8	79	0.109	100	100	0.8	0	247	186	131	179	147	178	690	164	74	70	74	70	74	-0.029	5.5	0.57
480	77.625	77.739	0.16	0.16	1.35	85	1.84	1.08	85	1.8	79	0.110	100	100	0.7	-0.1	247	185	131	179	147	178	692	164	74	70	74	70	73	-0.029	5.52	0.58
485	78.437	78.549	0.16	0.16	1.34	85	1.84	1.07	85	1.8	79	0.110	100	100	0.6	-0.1	250	184	131	179	146	178	674	164	74	70	74	70	74	-0.029	5.07	0.56
490	79.248	79.360	0.16	0.16	1.35	85	1.84	1.07	85	1.8	79	0.112	99	99	0.5	-0.1	251	183	130	178	147	178	664	164	74	70	74	70	74	-0.029	4.92	0.55
495	80.059	80.170	0.16	0.16	1.36	85	1.84	1.07	85	1.8	79	0.111	99	99	0.4	-0.1	250	182	129	176	147	177	659	162	74	70	74	70	74	-0.029	4.84	0.53
500	80.869	80.980	0.16	0.16	1.35	85	1.84	1.07	85	1.8	79	0.112	99	99	0.4	0	249	181	128	174	147	176	644	161	74	70	74	70	73	-0.028	4.64	0.53
505	81.681	81.791	0.16	0.16	1.36	85	1.84	1.08	85	1.8	78	0.110	100	100	0.3	-0.1	246	180	127	173	147	175	629	161	74	70	74	70	73	-0.028	4.4	0.51
510	82.493	82.601	0.16	0.16	1.35	85	1.84	1.08	85	1.8	78	0.109	100	100	0.3	0	244	179	126	171	147	173	614	156	74	70	74	70	73	-0.027	4.32	0.51
515	83.305	83.413	0.16	0.16	1.36	85	1.84	1.07	85	1.8	78	0.111	99	99	0.2	-0.1	241	178	124	170	146	172	603	153	74	70	74	70	73	-0.026	4.31	0.51
520	84.116	84.223	0.16	0.16	1.35	85	1.84	1.07	85	1.8	78	0.111	99	99	0.1	-0.1	240	177	123	169	145	171	597	154	74	70	74	70	73	-0.027	4.32	0.52
525	84.928	85.033	0.16	0.16	1.35	85	1.84	1.08	85	1.8	78	0.111	99	99	0.1	0	239	176	121	167	144	169	592	152	74	70	74	70	73	-0.026	4.25	0.52
530	85.738	85.844	0.16	0.16	1.35	85	1.84	1.07	85	1.8	78	0.112	99	99	0.0	-0.1	237	175	120	165	144	168	584	153	74	70	74	70	73	-0.025	4.69	0.49
Avg/Tot	85.738	85.844	0.16	0.16	1.35	83		1.07	83		83	0.111	100	100								108.0				70	74	70	72	-0.039		

OMNI-Test Laboratories

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Date: 04/24/19
Run: 4
Control #: 0135WS043E
Test Duration: 530
Output Category: 2

Technicians:

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	79.8%	86.2%
Combustion Efficiency	96.2%	96.2%
Heat Transfer Efficiency	83%	89.6%

Output Rate (kJ/h)	14,741	13,983	**(Btu/h)**
Burn Rate (kg/h)	0.93	2.06	**(lb/h)**
Input (kJ/h)	18,477	17,528	**(Btu/h)**

Test Load Weight (dry kg)	8.24	18.16	**dry lb**
MC wet (%)	17.46		
MC dry (%)	21.15		
Particulate (g)	5.7		
CO (g)	461		
Test Duration (h)	8.83		

Emissions	**Particulate**	**CO**
g/MJ Output	0.04	3.54
g/kg Dry Fuel	0.69	55.95
g/h	0.65	52.19
lb/MM Btu Output	0.10	8.23

Air/Fuel Ratio (A/F)	14.87

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

VERSION: 2.2 12/14/2009

Manufacturer:	Hearth & Home		**Appliance Type:**	Cat	
Model:	Defiant 1975-CAT-C				
Date:	4/24/2019		**Temp. Units**	F	(F or C)
Run:	4		**Weight Units**	lb	(kg or lb)
Control #:	0135WS043E				
Test Duration:	530				
Output Category:	2		**Fuel Data**		
				D. Fir	
Wood Moisture (% wet):	17.46		**HHV**	19,810	kj/kg
Load Weight (lb wet):	22.00		**%C**	48.73	
Burn Rate (dry kg/h):	0.93		**%H**	6.87	
Total Particulate Emissions:	5.7	g	**%O**	43.9	
			%ASH	0.5	

Averages	**0.47**	**7.74**	**#DIV/0!**	**204.43**	**72.40**	
				Temp. (ºF)		
Elapsed Time (min)	**Fuel Weight Remaining (lb)**	**Flue Gas Composition (%) CO**	**CO_2**	**O_2**	**Flue Gas**	**Room Temp**
0	22.00	0.13	2.03		245	71
5	21.70	0.64	8.86		224	70
10	21.40	0.39	9.07		229	69
15	21.10	0.43	9.55		233	70
20	20.80	0.38	10.20		240	69
25	20.40	0.34	10.64		246	70
30	20.00	0.26	10.82		250	69
35	19.60	0.14	11.06		257	69
40	19.20	0.07	10.84		258	70
45	18.70	0.06	11.07		261	71
50	18.30	0.07	11.36		268	71
55	17.80	0.06	11.15		263	72
60	17.40	0.39	12.03		275	71
65	16.80	0.21	11.75		279	72
70	16.30	0.19	11.37		277	72
75	15.80	0.28	11.73		278	72
80	15.30	0.27	11.50		276	71
85	14.90	0.26	11.50		278	72
90	14.40	0.22	11.74		270	73
95	13.80	0.45	11.65		271	72
100	13.40	0.56	11.80		271	71
105	12.90	0.68	11.86		270	71

110	12.40	0.87	11.51		272	72
115	11.90	0.95	11.23		264	72
120	11.50	0.76	10.63		257	72
125	11.10	0.71	10.49		252	72
130	10.70	0.65	10.40		248	72
135	10.20	0.70	10.57		245	72
140	9.90	0.54	10.12		242	72
145	9.50	0.43	9.86		237	72
150	9.20	0.42	9.37		232	71
155	8.90	0.36	8.94		230	71
160	8.70	0.31	8.99		223	72
165	8.50	0.34	8.81		219	71
170	8.20	0.25	8.85		216	71
175	8.00	0.35	8.64		212	72
180	7.80	0.36	8.64		213	72
185	7.50	0.73	8.69		223	72
190	7.30	0.77	8.86		221	72
195	7.00	0.72	8.65		220	71
200	6.80	0.76	8.73		221	72
205	6.60	0.76	8.77		219	72
210	6.40	0.74	8.56		218	72
215	6.10	0.74	8.62		215	72
220	5.90	0.72	8.51		219	72
225	5.70	0.63	8.10		214	73
230	5.50	0.43	8.04		209	72
235	5.40	0.42	7.85		203	72
240	5.20	0.44	7.72		199	73
245	5.10	0.47	7.64		198	72
250	4.90	0.44	7.36		194	73
255	4.80	0.44	7.22		195	73
260	4.70	0.45	7.19		193	73
265	4.50	0.53	7.16		190	73
270	4.40	0.48	6.99		188	73
275	4.30	0.52	7		188	72
280	4.20	0.51	6.76		186	73
285	4.10	0.5	6.65		192	73
290	4.00	0.49	6.51		185	73
295	3.90	0.5	7.11		185	73
300	3.80	0.47	6.86		184	73
305	3.70	0.47	6.64		185	73
310	3.60	0.46	6.57		184	73
315	3.50	0.46	6.48		180	73

320	3.40	0.46	6.27		181	73
325	3.30	0.47	6.16		181	73
330	3.30	0.49	6.41		177	73
335	3.20	0.49	6.51		180	73
340	3.10	0.48	6.5		180	73
345	3.00	0.45	6.3		175	73
350	2.90	0.43	6.49		175	73
355	2.80	0.39	6.9		172	73
360	2.70	0.38	6.64		170	73
365	2.60	0.4	6.65		168	73
370	2.50	0.42	6.31		168	73
375	2.40	0.45	6.11		169	73
380	2.30	0.54	6.09		170	73
385	2.30	0.53	6.13		173	73
390	2.20	0.54	6.14		173	73
395	2.10	0.53	6.02		173	73
400	2.00	0.4	6.07		174	73
405	1.90	0.41	5.99		167	73
410	1.80	0.44	6.04		166	74
415	1.70	0.46	5.98		166	73
420	1.60	0.44	5.97		163	74
425	1.60	0.46	5.79		165	74
430	1.50	0.44	5.87		163	74
435	1.40	0.44	5.68		166	74
440	1.30	0.51	5.49		166	74
445	1.20	0.54	5.59		167	74
450	1.20	0.52	5.35		168	74
455	1.10	0.51	5.17		168	74
460	1.00	0.52	5.08		164	74
465	0.90	0.52	5.01		165	74
470	0.80	0.54	5.2		164	74
475	0.80	0.57	5.5		164	74
480	0.70	0.58	5.52		164	73
485	0.60	0.56	5.07		164	74
490	0.50	0.55	4.92		164	74
495	0.40	0.53	4.84		162	74
500	0.40	0.53	4.64		161	73
505	0.30	0.51	4.4		161	73
510	0.30	0.51	4.32		156	73
515	0.20	0.51	4.31		153	73
520	0.10	0.52	4.32		154	73
525	0.10	0.52	4.25		152	73

530	0.00	0.49	4.69		153	73

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 4

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/24/19

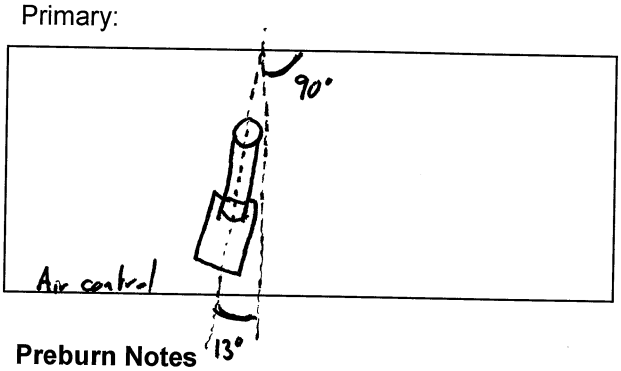
Test Crew: BDAVIS

OMNI Equipment ID numbers:

Wood Heater Run Notes

Air Control Settings

Primary:



Secondary: fixed

Tertiary/Pilot: N/A

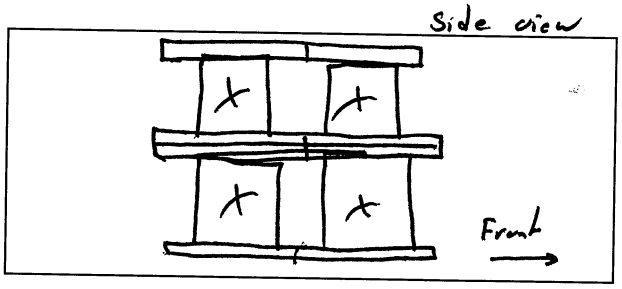
Fan: on High

Preburn Notes

Time	Notes
0	Prior to starting Preburn stove was operated with doors cracked open until scale read 24.0 lbs. Closed doors and continued operating with door closed bypass open until 12.0 lbs
25	Raked coals
51	Raked coals

Test Notes

Sketch test fuel configuration:



Start up procedures & Timeline:

Bypass: Closed by 75 seconds
Fuel loaded by: 75 seconds
Door closed at: 75 seconds
Primary air: At test setting entire test Fan on High.

Notes: Preburn coal bed weight was not zero at the start of test.

Time	Notes
60	Changed Front filter in train A.

Technician Signature: Date: 5/7/19

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 4

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/24/18

Test Crew: Bruce D R Lucy T

OMNI Equipment ID numbers:

Wood Heater Fuel Data

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

Pre-Burn Fuel

Calibration: Cal Value (1) = 12% Actual Reading 12

Cal Value (2) = 22% Actual Reading 22

Piece:	Length:	Reading:	Piece:	Length:	Reading:
1	72 in	19.5	7	____ in	____
2	72 in	19.0	8	____ in	____
3	48 in	20.5	9	____ in	____
4	48 in	20.5	10	____ in	____
5	36 in	19.8	11	____ in	____
6	____ in	____	12	____ in	____

Total Pre-Burn Fuel Weight: 295 Pre-Burn Fuel Average Moisture: 19.8%

Time (clock): 8:45 Room Temperature (F): 71 Initials: RT

Test Fuel

Firebox Volume (ft³): 3.25 Test Fuel Piece Length (in): 20"

Load Weight Range (lb): 20.5 - 22.75 - 25.0 Total Wet Fuel Load Weight (lb): 22.0 (4.4 - 5.5)

Fuel Type & Amount: 2 x 4: 0 4 x 4: 4

Weight (with spacers): N/A Weight (with spacers): 22.0

Piece:	Weight (lbs):	Moisture Readings (%DB):				Fuel Type:
1	4.4	21.2	22.1	22.1		4x4
2	4.4	20.4	22.3	21.1		4x4
3	6.0	21.2	22.0	20.9		4x4
4	5.3	20.4	19.1	21.1		4x4
5						
6						
7						

Spacer Moisture Readings (%DB)

9.0	7.8	8.2	7.3				
11.4	9.1	8.1	12.9				
12.5	8.5	9.1	8.3				
9.0	12.3	8.0	8.2				

Time (clock): 10:12 Room Temperature (F): 71 Initials: RT

Technician Signature: Date: 5/7/18

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 4

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/24/19

Test Crew: D Davis R Tiggs

OMNI Equipment ID numbers:

Wood Heater Supplemental Data

Start Time: 10:46 Booth #: E1

Stop Time: 19:36

Stack Gas Leak Check:

Initial: good Final: good

Sample Train Leak Check:

A: 0.0 @ 6 "Hg

B: 0.0 @ 4 "Hg

Calibrations: Span Gas CO_2: 10.08 CO: 2.53

	Pre Test		Post Test	
	Zero	Span	Zero	Span
Time	1022	1023	1937	1937
CO_2	0.00	10.09	0.00	10.00
CO	0.000	2.53	-0.001	2.513

Air Velocity (ft/min): Initial: 450 Final: 450

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

Pitot Tube Leak Test: Initial: good Final: good

Stack Diameter (in): 8

Induced Draft: 0.0

% Smoke Capture: 100%

Flue Pipe Cleaned Prior to First Test in Series:

Date: 4/18/19 Initials: AA

	Initial	Middle	Ending
P_b (in/Hg)	30.38		30.24
RH (%)	30.2		26.6
Ambient (°F)	71		73

Tunnel Traverse

Microtector Reading	dP (in H_2O)	T(°F)
	.064	92
	.096	92
	.104	92
	.068	92
	.074	92
	.108	92
	.094	92
	.074	92
Center:		
	.116	92

Tunnel Static Pressure (in H_2O):	
Beginning of Test	End of Test
-.40	-.40

Background Filter Volume: N/A

Technician Signature:

Date: 5/7/19

Run 5

Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Project No.: 0135WS043E
Tracking No.: 2366
Run: 5
Test Date: 4/25/2019

Burn Rate	**1.24 kg/hr dry**
Average Tunnel Temperature	93 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	20.02 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	13297.4 dscf/hour
Average Delta p	0.111 inches H20
Total Time of Test	390 minutes

	AMBIENT	SAMPLE TRAIN 1	SAMPLE TRAIN 2	FIRST HOUR FILTER (TRAIN 1)
Total Sample Volume - Vm	0.000 cubic feet	63.095 cubic feet	63.403 cubic feet	9.628 cubic feet
Average Gas Meter Temperature	75 degrees Fahrenheit	85 degrees Fahrenheit	87 degrees Fahrenheit	84 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	0.000 dscf	62.977 dscf	61.399 dscf	9.624 dscf
Total Particulates - m_n	0 mg	5.8 mg	5.7 mg	0.3 mg
Particulate Concentration (dry-standard) - C_f/C_s	0.000000 grams/dscf	0.00009 grams/dscf	0.00009 grams/dscf	0.00003 grams/dscf
Total Particulate Emissions - E_T	0.00 grams	7.96 grams	8.02 grams	0.41 grams
Particulate Emission Rate	0.00 grams/hour	1.22 grams/hour	1.23 grams/hour	0.41 grams/hour
Emissions Factor		0.99 g/kg	0.99 g/kg	0.17 g/kg
Difference from Average Total Particulate Emissions		0.03 grams	0.03 grams	

Dual Train Comparison Results Are Acceptable

FINAL AVERAGE RESULTS

Complete Test Run	
Total Particulate Emissions - E_T	7.99 grams
Particulate Emission Rate	**1.23 grams/hour**
Emissions Factor	0.99 grams/kg
First Hour Emissions	
Total Particulate Emissions - E_T	0.41 grams
Particulate Emission Rate	0.41 grams/hour
Emissions Factor	0.17 grams/kg

QUALITY CHECKS

Filter Temps < 90 °F	OK
Filter Face Velocity (47 mm)	OK
Dryer Exit Temp < 80F	OK
Leakage Rate	OK
Ambient Temp (55-90°F)	OK
Negative Probe Weight Eval.	OK
Pro-Rate Variation	OK
Stove Surface ΔT	OK
Train Precision 7.5%	0.40
Train Precision 0.5g/kg	0.01

Technician Signature:_____

Wood Heater Preburn Data - ASTM E2780

Run:	**5**
Manufacturer:	Hearth & Home
Model:	Defiant 1975-CAT-C
Tracking No.:	2366
Project No.:	0135WS043E
Test Date:	4/25/2019
Beginning Clock Time:	9:27

Coal Bed Range (lb):	**4.3** (min)	**5.3** (max)

Technician Signature: 

			Temperatures (°F)							
Elapsed Time (min)	Scale (lb)	Stack Draft (in H_2O)	FB Top	FB Bottom	FB Back	FB Left	FB Right	Avg. Firebox Surface	Stack	Ambient
0	12.2	-0.06	630	338	203	322	288	356.2	411	71
5	11.3	-0.049	561	340	212	334	307	350.8	245	70
10	10.7	-0.056	498	333	229	330	310	340	283	71
15	10.1	-0.062	454	328	268	322	305	335.4	321	71
20	9.4	-0.059	424	325	322	314	298	336.6	334	71
25	8.9	-0.057	407	322	360	307	292	337.6	306	70
30	8.4	-0.056	393	321	385	302	287	337.6	297	71
35	7.5	-0.062	400	321	405	300	284	342	337	72
40	6.7	-0.06	393	316	423	304	295	346.2	314	71
45	6.1	-0.058	385	310	436	305	314	350	301	72
50	5.7	-0.055	382	304	442	304	332	352.8	293	71
55	5.3	-0.054	384	302	442	304	343	355	286	72
60	5	-0.052	394	303	440	306	347	358	279	72
65	4.7	-0.05	409	303	434	310	350	361.2	271	72
70	4.5	-0.047	396	302	427	314	350	357.8	254	71
73	4.3	-0.046	390	302	422	317	352	356.6	271	73

Wood Heater Test Fuel Data - ASTM E2780

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 4/25/2019
Run No.: 5

Firebox Volume (ft^3):	3.25
Fuel Piece Length (in):	20
2x4 Crib Weight (lb):	
4x4 Crib Weight (lb):	21.3

Total Fuel Weight (Dry Basis, lb):	17.8	
Fuel Density (lb/ft^3, Dry Basis):	28.70	OK
Loading Density (lb/ft^3, Wet Basis):	6.55	OK
2x4 Percentage:	N/A	N/A

Coal Bed Range (20-25%): **4.26 - 5.325**

Test Fuel Piece	Weight (lb)	Size	Readings (Dry Basis %)			Dry Weight (lb)
1	5.2	4"x 4"	20.8	18.7	20.4	4.33
2	5.2	4"x 4"	19.5	19.3	21.1	4.33
3	4.3	4"x 4"	22.7	19.8	19.4	3.56
4	4.9	4"x 4"	22.2	22.6	18.7	4.04

Spacer Readings (Dry Basis %)			
10.9	8.9		
10.6	13.0		
12.0	12.8		
11.4			
12.0			
13.2			
11.5			
12.9			
12.3			
9.5			
11.4			
14.0			
13.7			

Technician Signature: 

Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer:	Hearth & Home	Equipment Numbers:	283A, 637, 592
Model:	Defiant 1975-CAT-C		
Tracking No.:	2366		
Project No.:	0135WS043E		
Run #:	5		
Date:	4/25/2019		

TRAIN 1 (First Hour emissions)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	D750	121.8	121.5	0.3
C. Rear filter catch	Filter				0.0
D. Probe catch*	Probe				0.0
E. Filter seals catch*	Seals				0.0

Sub-Total | Total Particulate, mg: | 0.3

TRAIN 1 (Post First Hour Change-out)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	D741	124.7	121.4	3.3
C. Rear filter catch	Filter	D751	121.7	121.2	0.5
D. Probe catch*	Probe	9	115692.8	115692.1	0.7
E. Filter seals catch*	Seals	R773	3382.4	3381.4	1.0

Sub-Total | Total Particulate, mg: | 5.5

Train 1 Aggregate | Total Particulate, mg: | **5.8**

TRAIN 2

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	D743	124.7	120.8	3.9
B. Rear filter catch	Filter	D744	119.7	119.5	0.2
C. Probe catch*	Probe	69	117370.1	117369.4	0.7
D. Filter seals catch*	Seals	R772	3621.6	3620.7	0.9

Total Particulate, mg: | **5.7**

AMBIENT

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

Total Particulate, mg: | **0.0**

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

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

Technician Signature: 

Wood Heater Test Data - ASTM E2780 / ASTM E2515

Run: 5

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 4/25/2019
Beginning Clock Time: 10:40

Total Sampling Time: 390 min
Recording Interval: 5 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.022 (1) 0.995 (2) _____ (Amb)

Barometric Pressure:

Begin	Middle	End	Average
30.11	30.08	30.04	30.08 "Hg

OMNI Equipment Numbers: _____

PM Control Modules: 335, 336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.390 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 20.02 ft/sec.
Initial Tunnel Flow: 219.8 scfm
Average Tunnel Flow: 221.6 scfm
Post-Test Leak Check (1): 0.000 cfm @ 8 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 9 in. Hg
Average Test Piece Fuel Moisture: 20.43 Dry Basis %

Technician Signature: _____

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.068	0.088	0.104	0.070	0.076	0.104	0.100	0.078	0.112	"H2O
Temp:	88	88	89	89	89	89	89	89	88	

V_{strav} 20.01 ft/sec V_{scent} 22.53 ft/sec F_p 0.888

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)													Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface Temp	Catalyst Exit Temp	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
0	0.000	0.000			1.13	74	1.73	0.69	76	1.8	104	0.111			21.3		387	301	421	317	351	355	1001	254	73	66	72	67	72	-0.046	8.39	0.13
5	0.789	0.792	0.16	0.16	1.31	75	1.81	1.05	76	1.8	93	0.112	99	99	21.0	-0.3	338	296	412	309	339	339	1045	252	75	69	74	70	72	-0.051	9.29	0.17
10	1.579	1.584	0.16	0.16	1.29	75	1.79	1.04	77	1.8	92	0.111	99	99	20.6	-0.4	301	291	412	292	320	323	1125	275	75	69	74	69	72	-0.053	9.56	0.11
15	2.381	2.396	0.16	0.16	1.37	76	1.86	1.10	77	1.8	92	0.113	100	101	20.1	-0.5	275	286	421	277	304	313	1184	281	75	69	75	68	73	-0.055	10.41	0.1
20	3.188	3.207	0.16	0.16	1.38	77	1.88	1.03	78	1.8	92	0.112	101	101	19.7	-0.4	267	283	433	265	291	308	1215	293	75	69	75	68	72	-0.056	10.44	0.11
25	4.004	3.998	0.16	0.16	1.38	78	1.88	1.03	79	1.8	94	0.113	101	98	19.2	-0.5	270	279	446	257	282	307	1263	302	76	69	75	68	72	-0.058	11.54	0.15
30	4.818	4.789	0.16	0.16	1.39	79	1.88	1.03	80	1.8	95	0.112	101	98	18.6	-0.6	289	276	462	251	276	311	1320	314	76	69	75	69	72	-0.060	11.76	0.41
35	5.634	5.581	0.16	0.16	1.39	79	1.89	1.03	81	1.8	96	0.113	101	98	18.1	-0.5	305	273	476	249	275	316	1336	321	76	70	76	69	72	-0.060	11.76	0.63
40	6.440	6.386	0.16	0.16	1.32	80	1.81	1.11	81	1.9	96	0.111	101	100	17.5	-0.6	307	270	487	248	277	318	1342	321	76	71	76	70	72	-0.060	11.59	0.67
45	7.237	7.210	0.16	0.16	1.31	80	1.82	1.11	82	1.9	97	0.111	100	103	16.9	-0.6	321	268	494	248	284	323	1363	316	76	71	76	70	72	-0.059	11.99	0.93
50	8.033	8.034	0.16	0.16	1.32	81	1.82	1.12	83	1.9	98	0.113	99	102	16.3	-0.6	339	267	498	250	289	329	1350	319	76	72	77	71	73	-0.060	11.84	1.03
55	8.831	8.855	0.16	0.16	1.31	81	1.81	1.08	83	1.8	98	0.112	99	102	15.6	-0.7	351	266	500	252	296	333	1347	312	77	72	77	71	74	-0.061	12.02	1.27
60	9.628	9.667	0.16	0.16	1.32	82	1.82	1.08	84	1.9	98	0.112	99	100	15.0	-0.6	364	265	500	255	303	337	1342	321	77	73	77	72	72	-0.060	11.96	1.57
65	10.427	10.479	0.16	0.16	1.32	82	1.81	1.08	84	1.8	98	0.110	100	101	14.4	-0.6	374	265	499	259	312	342	1326	310	78	73	77	73	74	-0.061	11.74	1.62
70	11.227	11.292	0.16	0.16	1.31	83	1.81	1.08	84	1.9	97	0.111	100	101	13.8	-0.6	371	265	496	262	325	344	1279	302	78	73	77	73	74	-0.058	11.1	1.35
75	12.033	12.105	0.16	0.16	1.34	83	1.84	1.08	85	1.9	97	0.113	99	100	13.3	-0.5	370	264	489	265	338	345	1267	295	77	74	77	73	74	-0.057	11.27	1.19
80	12.841	12.918	0.16	0.16	1.34	83	1.84	1.08	85	1.9	97	0.113	100	100	12.8	-0.5	371	264	483	268	348	347	1257	296	77	74	77	74	74	-0.057	10.97	1.21
85	13.650	13.730	0.16	0.16	1.34	83	1.85	1.08	85	1.9	97	0.111	101	101	12.3	-0.5	374	263	477	271	358	349	1229	293	77	74	77	74	74	-0.056	11.12	0.93
90	14.459	14.543	0.16	0.16	1.34	84	1.84	1.08	85	1.9	96	0.112	100	100	11.8	-0.5	374	263	472	274	367	350	1217	291	77	74	78	74	73	-0.055	11.25	0.9
95	15.268	15.356	0.16	0.16	1.34	84	1.85	1.08	86	1.9	96	0.112	100	100	11.3	-0.5	378	263	467	276	375	352	1220	286	77	74	78	74	75	-0.055	11.39	1
100	16.077	16.169	0.16	0.16	1.35	84	1.84	1.08	86	1.9	96	0.111	100	100	10.9	-0.4	380	262	464	278	380	353	1215	284	77	74	78	75	74	-0.053	11.23	0.84
105	16.886	16.983	0.16	0.16	1.34	84	1.84	1.08	86	1.9	97	0.111	101	101	10.4	-0.5	383	261	461	281	385	354	1229	285	77	74	78	75	75	-0.054	11.2	1.1
110	17.695	17.796	0.16	0.16	1.34	84	1.85	1.08	86	1.9	97	0.111	101	100	9.9	-0.5	388	261	459	284	392	357	1233	284	77	75	78	75	75	-0.054	11.26	1.3
115	18.504	18.609	0.16	0.16	1.34	85	1.85	1.08	86	1.9	97	0.111	100	100	9.4	-0.5	390	261	458	287	398	359	1239	285	77	75	78	75	75	-0.054	11.38	1.44
120	19.313	19.423	0.16	0.16	1.34	85	1.84	1.08	87	1.9	97	0.111	100	100	9.0	-0.4	390	260	458	290	401	360	1199	286	77	75	78	75	76	-0.053	10.9	0.82
125	20.122	20.237	0.16	0.16	1.34	85	1.85	1.08	87	1.9	97	0.110	101	101	8.6	-0.4	391	260	455	292	401	360	1180	285	78	75	78	75	76	-0.052	10.78	0.69
130	20.931	21.050	0.16	0.16	1.34	85	1.84	1.08	87	1.9	97	0.111	100	100	8.2	-0.4	391	259	450	294	401	359	1151	281	78	75	78	76	76	-0.052	10.63	0.6
135	21.741	21.863	0.16	0.16	1.35	85	1.85	1.08	87	1.9	96	0.111	100	100	7.8	-0.4	396	258	445	296	401	359	1106	274	78	75	78	76	76	-0.050	10.29	0.4
140	22.550	22.677	0.16	0.16	1.34	85	1.85	1.07	87	1.9	96	0.110	101	101	7.5	-0.3	395	258	438	297	400	358	1063	271	78	75	78	76	75	-0.049	9.73	0.32
145	23.360	23.490	0.16	0.16	1.34	85	1.85	1.07	87	1.9	95	0.110	101	101	7.2	-0.3	395	257	430	299	400	356	1046	265	78	75	78	76	76	-0.048	9.84	0.35
150	24.170	24.304	0.16	0.16	1.34	85	1.85	1.08	87	1.9	95	0.111	100	100	6.9	-0.3	398	257	422	301	400	356	1033	264	78	75	78	76	76	-0.048	9.76	0.36
155	24.980	25.117	0.16	0.16	1.33	86	1.85	1.08	87	1.9	95	0.110	101	101	6.6	-0.3	396	256	416	303	399	354	1016	256	78	75	78	76	76	-0.046	9.69	0.35
160	25.790	25.931	0.16	0.16	1.33	86	1.84	1.08	88	1.9	95	0.112	100	100	6.3	-0.3	393	256	410	305	397	352	1013	257	78	75	78	76	75	-0.046	9.57	0.38
165	26.600	26.745	0.16	0.16	1.33	86	1.84	1.08	88	1.9	94	0.111	100	100	6.0	-0.3	393	255	405	306	395	351	1015	259	78	75	78	76	75	-0.047	9.62	0.43
170	27.410	27.558	0.16	0.16	1.34	86	1.85	1.08	88	1.9	94	0.111	100	100	5.7	-0.3	394	254	402	307	393	350	1016	257	78	75	79	76	76	-0.047	9.58	0.42
175	28.220	28.372	0.16	0.16	1.34	86	1.85	1.08	88	1.9	95	0.111	100	100	5.4	-0.3	394	253	399	308	391	349	1009	253	78	75	78	76	77	-0.046	9.41	0.42
180	29.029	29.186	0.16	0.16	1.34	86	1.85	1.08	88	1.9	94	0.112	99	100	5.2	-0.2	391	252	395	309	390	347	1002	250	78	75	78	76	76	-0.045	9.24	0.44
185	29.839	30.000	0.16	0.16	1.34	86	1.84	1.08	88	1.9	94	0.111	100	100	5.0	-0.2	387	252	392	309	388	346	984	247	78	75	79	76	77	-0.045	9.01	0.38

Wood Heater Test Data - ASTM E2780 / ASTM E2515

Run: 5

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 4/25/2019
Beginning Clock Time: 10:40

Total Sampling Time: 390 min
Recording Interval: 5 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.022 (1) 0.995 (2) _____ (Amb)

Barometric Pressure:	Begin	Middle	End	Average
	30.11	30.08	30.04	30.08 "Hg

OMNI Equipment Numbers: _____

PM Control Modules: 335, 336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.390 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 20.02 ft/sec.
Initial Tunnel Flow: 219.8 scfm
Average Tunnel Flow: 221.6 scfm
Post-Test Leak Check (1): 0.000 cfm @ 8 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 9 in. Hg
Average Test Piece Fuel Moisture: 20.43 Dry Basis %

Technician Signature: _____

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.068	0.088	0.104	0.070	0.076	0.104	0.100	0.078	0.112	"H2O
Temp:	88	88	89	89	89	89	89	89	88	

V_{strav} 20.01 ft/sec V_{scent} 22.53 ft/sec F_p 0.888

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)												Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface Temp	Catalyst Exit Temp	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
190	30.649	30.814	0.16	0.16	1.34	86	1.84	1.08	88	1.9	94	0.111	100	100	4.7	-0.3	382	251	388	309	386	343	980	244	78	75	79	76	77	-0.044	9.05	0.39
195	31.459	31.628	0.16	0.16	1.34	87	1.85	1.08	88	1.9	94	0.110	100	100	4.4	-0.3	390	251	385	309	382	343	1001	245	78	75	79	76	76	-0.046	9.68	0.48
200	32.269	32.442	0.16	0.16	1.34	87	1.84	1.08	88	1.9	94	0.111	100	100	4.2	-0.2	397	251	383	311	378	344	971	244	78	75	79	76	78	-0.044	9.03	0.4
205	33.079	33.256	0.16	0.16	1.34	87	1.85	1.07	88	1.9	94	0.110	100	100	4.0	-0.2	402	250	380	314	374	344	946	239	78	75	79	76	77	-0.043	8.84	0.38
210	33.890	34.070	0.16	0.16	1.33	87	1.85	1.08	89	1.9	94	0.111	100	100	3.7	-0.3	403	250	376	316	371	343	935	239	78	75	79	76	77	-0.043	8.94	0.4
215	34.700	34.884	0.16	0.16	1.33	87	1.85	1.07	88	1.9	93	0.111	100	100	3.5	-0.2	400	250	371	317	368	341	925	238	78	75	79	76	77	-0.043	8.8	0.41
220	35.510	35.698	0.16	0.16	1.33	87	1.84	1.07	89	1.9	94	0.112	99	99	3.3	-0.2	398	250	368	317	364	339	906	235	78	75	79	76	77	-0.041	8.55	0.37
225	36.320	36.512	0.16	0.16	1.34	87	1.84	1.07	89	1.9	93	0.111	100	100	3.2	-0.1	397	250	363	318	360	338	879	231	78	75	79	76	77	-0.040	8.16	0.36
230	37.130	37.325	0.16	0.16	1.34	87	1.84	1.07	89	1.9	93	0.111	100	100	3.0	-0.2	399	251	358	318	357	337	849	228	78	75	79	76	77	-0.039	8	0.34
235	37.940	38.139	0.16	0.16	1.34	87	1.85	1.08	89	1.9	93	0.112	99	99	2.9	-0.1	397	252	352	317	353	334	819	221	78	75	79	76	77	-0.038	7.82	0.29
240	38.750	38.954	0.16	0.16	1.34	87	1.85	1.08	89	1.9	92	0.111	100	100	2.8	-0.1	397	252	345	317	349	332	794	217	78	75	79	76	77	-0.037	7.61	0.29
245	39.561	39.768	0.16	0.16	1.34	87	1.84	1.07	89	1.9	92	0.110	100	100	2.7	-0.1	395	252	338	317	343	329	780	213	78	75	79	76	76	-0.037	7.5	0.3
250	40.372	40.582	0.16	0.16	1.33	87	1.84	1.08	89	1.9	91	0.110	100	100	2.5	-0.2	394	253	331	317	339	327	764	211	78	75	79	76	77	-0.037	7.47	0.31
255	41.183	41.397	0.16	0.16	1.33	87	1.85	1.08	89	1.9	91	0.110	100	100	2.4	-0.1	395	253	326	316	333	325	755	210	78	75	79	76	77	-0.036	7.43	0.29
260	41.994	42.211	0.16	0.16	1.34	87	1.84	1.08	89	1.9	91	0.110	100	100	2.3	-0.1	395	254	320	316	329	323	748	206	78	75	79	76	77	-0.036	7.34	0.34
265	42.806	43.026	0.16	0.16	1.34	87	1.85	1.08	89	1.9	91	0.110	100	100	2.2	-0.1	393	254	315	314	325	320	750	205	78	74	79	75	76	-0.035	7.28	0.35
270	43.616	43.841	0.16	0.16	1.35	87	1.84	1.08	89	1.9	91	0.110	100	100	2.1	-0.1	391	254	310	313	322	318	744	205	78	74	78	75	77	-0.035	7.12	0.34
275	44.428	44.656	0.16	0.16	1.34	88	1.85	1.08	89	1.9	90	0.109	100	100	2.0	-0.1	388	254	306	311	319	316	737	201	78	74	78	75	77	-0.034	7.17	0.34
280	45.239	45.471	0.16	0.16	1.34	88	1.84	1.08	89	1.9	90	0.110	100	100	1.9	-0.1	383	254	302	309	317	313	735	201	78	74	78	75	76	-0.034	7.19	0.35
285	46.051	46.286	0.16	0.16	1.34	87	1.85	1.07	89	1.9	90	0.110	100	100	1.8	-0.1	380	254	298	308	315	311	732	200	78	74	78	75	77	-0.033	7.07	0.36
290	46.863	47.101	0.16	0.16	1.33	88	1.84	1.08	89	1.9	90	0.111	100	100	1.8	0	376	254	295	306	313	309	736	197	78	74	78	75	77	-0.033	7.1	0.4
295	47.674	47.916	0.16	0.16	1.34	88	1.84	1.08	89	1.9	90	0.110	100	100	1.7	-0.1	373	254	293	304	311	307	739	197	78	74	78	75	76	-0.032	7.07	0.4
300	48.485	48.731	0.16	0.16	1.34	87	1.84	1.08	89	1.9	90	0.112	99	99	1.6	-0.1	371	253	290	302	310	305	741	199	78	74	78	75	77	-0.033	7.14	0.42
305	49.296	49.546	0.16	0.16	1.34	88	1.84	1.07	89	1.9	89	0.110	100	100	1.5	-0.1	366	252	289	300	308	303	742	198	78	74	78	75	77	-0.033	7.06	0.42
310	50.107	50.361	0.16	0.16	1.34	88	1.84	1.08	89	1.9	89	0.110	100	100	1.4	-0.1	367	252	287	298	307	302	728	198	78	74	78	75	76	-0.033	6.7	0.35
315	50.919	51.175	0.16	0.16	1.33	88	1.85	1.07	89	1.9	89	0.110	100	100	1.3	-0.1	363	250	284	297	304	300	707	194	78	74	78	75	76	-0.033	6.59	0.35
320	51.731	51.990	0.16	0.16	1.33	88	1.84	1.08	89	1.9	89	0.112	99	99	1.2	-0.1	362	250	282	296	301	298	698	190	78	74	78	75	77	-0.032	6.54	0.34
325	52.543	52.806	0.16	0.16	1.34	88	1.85	1.08	89	1.9	88	0.111	99	99	1.1	-0.1	363	248	279	296	298	297	696	192	78	74	78	75	76	-0.032	6.53	0.37
330	53.354	53.621	0.16	0.16	1.34	87	1.84	1.08	89	1.9	88	0.100	105	105	1.0	-0.1	358	247	276	296	296	295	692	190	78	74	78	75	76	-0.031	6.46	0.36
335	54.166	54.436	0.16	0.16	1.34	88	1.84	1.08	89	1.9	88	0.112	99	99	1.0	0	353	246	274	295	293	292	683	192	78	74	78	75	76	-0.032	6.58	0.34
340	54.978	55.251	0.16	0.16	1.34	88	1.84	1.07	89	1.9	88	0.112	99	99	0.9	-0.1	350	246	271	295	290	290	679	189	78	74	78	75	76	-0.031	6.36	0.34
345	55.790	56.067	0.16	0.16	1.33	87	1.84	1.08	89	1.9	88	0.111	100	99	0.8	-0.1	346	246	269	294	288	289	667	186	78	74	78	75	76	-0.031	6.49	0.32
350	56.602	56.882	0.16	0.16	1.33	88	1.84	1.07	89	1.9	88	0.112	99	99	0.7	-0.1	350	246	267	293	285	288	668	184	78	74	78	74	77	-0.031	6.75	0.32
355	57.413	57.697	0.16	0.16	1.34	88	1.84	1.08	89	1.9	88	0.113	98	98	0.6	-0.1	349	245	265	291	283	287	644	183	78	74	78	74	77	-0.030	6.75	0.25
360	58.224	58.512	0.16	0.16	1.34	88	1.84	1.08	89	1.9	88	0.112	99	99	0.5	-0.1	348	246	263	289	281	285	633	183	78	74	78	74	76	-0.030	6.63	0.24
365	59.036	59.327	0.16	0.16	1.34	87	1.84	1.07	89	1.9	88	0.109	100	100	0.4	-0.1	347	247	260	288	280	284	628	181	78	74	78	74	76	-0.029	6.75	0.27
370	59.848	60.142	0.16	0.16	1.34	88	1.84	1.08	88	1.9	87	0.111	99	99	0.3	-0.1	347	249	258	286	278	284	629	177	78	74	78	74	77	-0.030	6.75	0.28
375	60.660	60.958	0.16	0.16	1.34	88	1.84	1.08	88	1.9	87	0.111	99	100	0.3	0	347	250	256	285	277	283	630	177	78	74	78	74	77	-0.029	6.75	0.29
380	61.472	61.773	0.16	0.16	1.34	88	1.85	1.08	88	1.9	87	0.111	99	99	0.2	-0.1	347	251	255	284	276	283	634	179	78	74	78	74	76	-0.029	6.68	0.3
385	62.284	62.588	0.16	0.16	1.33	87	1.84	1.08	88	1.9	87	0.111	99	99	0.1	-0.1	346	252	253	283	275	282	637	178	78	73	78	74	76	-0.030	6.61	0.32
390	63.095	63.403	0.16	0.16	1.34	87	1.84	1.08	88	1.9	87	0.111	99	99	0.0	-0.1	345	254	252	281	273	281	643	177	77	73	78	74	76	-0.029	6.71	0.35
Avg/Tot	63.095	63.403	0.16	0.16	1.34	85		1.07	87		93	0.111	100	100								74.4				74	78	74	75	-0.044		

OMNI-Test Laboratories

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Date: 04/25/19
Run: 5
Control #: 0135WS043E
Test Duration: 390
Output Category: 2

Technicians: _____

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	78.1%	84.4%
Combustion Efficiency	95.3%	95.3%
Heat Transfer Efficiency	82%	88.6%

Output Rate (kJ/h)	19,101	18,120	**(Btu/h)**
Burn Rate (kg/h)	1.23	2.72	**(lb/h)**
Input (kJ/h)	24,455	23,199	**(Btu/h)**

Test Load Weight (dry kg)	8.02	17.69	**dry lb**
MC wet (%)	16.97		
MC dry (%)	20.44		
Particulate (g)	7.99		
CO (g)	541		
Test Duration (h)	6.50		

Emissions	**Particulate**	**CO**
g/MJ Output	0.06	4.36
g/kg Dry Fuel	1.00	67.42
g/h	1.23	83.23
lb/MM Btu Output	0.15	10.13

Air/Fuel Ratio (A/F)	12.93

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

VERSION: 2.2 12/14/2009

Manufacturer:	Hearth & Home	**Appliance Type:**	Cat
Model:	Defiant 1975-CAT-C		
Date:	4/25/2019	**Temp. Units**	F (F or C)
Run:	5	**Weight Units**	lb (kg or lb)
Control #:	0135WS043E		
Test Duration:	390		
Output Category:	2		

		Fuel Data		
			D. Fir	
Wood Moisture (% wet):	16.97	**HHV**	19,810	kj/kg
Load Weight (lb wet):	21.30	**%C**	48.73	
Burn Rate (dry kg/h):	1.23	**%H**	6.87	
Total Particulate Emissions:	7.99 g	**%O**	43.9	
		%ASH	0.5	

Averages	**0.51**	**8.93**	**#DIV/0!**	**242.67**	**75.46**	
					Temp. (ºF)	
Elapsed Time (min)	**Fuel Weight Remaining (lb)**	**Flue Gas Composition (%) CO**	**CO_2**	**O_2**	**Flue Gas**	**Room Temp**
0	21.30	0.13	8.39		254	72
5	21.00	0.17	9.29		252	72
10	20.60	0.11	9.56		275	72
15	20.10	0.10	10.41		281	73
20	19.70	0.11	10.44		293	72
25	19.20	0.15	11.54		302	72
30	18.60	0.41	11.76		314	72
35	18.10	0.63	11.76		321	72
40	17.50	0.67	11.59		321	72
45	16.90	0.93	11.99		316	72
50	16.30	1.03	11.84		319	73
55	15.60	1.27	12.02		312	74
60	15.00	1.57	11.96		321	72
65	14.40	1.62	11.74		310	74
70	13.80	1.35	11.10		302	74
75	13.30	1.19	11.27		295	74
80	12.80	1.21	10.97		296	74
85	12.30	0.93	11.12		293	74
90	11.80	0.90	11.25		291	73
95	11.30	1.00	11.39		286	75
100	10.90	0.84	11.23		284	74
105	10.40	1.10	11.20		285	75

110	9.90	1.30	11.26		284	75
115	9.40	1.44	11.38		285	75
120	9.00	0.82	10.90		286	76
125	8.60	0.69	10.78		285	76
130	8.20	0.60	10.63		281	76
135	7.80	0.40	10.29		274	76
140	7.50	0.32	9.73		271	75
145	7.20	0.35	9.84		265	76
150	6.90	0.36	9.76		264	76
155	6.60	0.35	9.69		256	76
160	6.30	0.38	9.57		257	75
165	6.00	0.43	9.62		259	75
170	5.70	0.42	9.58		257	76
175	5.40	0.42	9.41		253	77
180	5.20	0.44	9.24		250	76
185	5.00	0.38	9.01		247	77
190	4.70	0.39	9.05		244	77
195	4.40	0.48	9.68		245	76
200	4.20	0.40	9.03		244	78
205	4.00	0.38	8.84		239	77
210	3.70	0.40	8.94		239	77
215	3.50	0.41	8.80		238	77
220	3.30	0.37	8.55		235	77
225	3.20	0.36	8.16		231	77
230	3.00	0.34	8.00		228	77
235	2.90	0.29	7.82		221	77
240	2.80	0.29	7.61		217	77
245	2.70	0.3	7.5		213	76
250	2.50	0.31	7.47		211	77
255	2.40	0.29	7.43		210	77
260	2.30	0.34	7.34		206	77
265	2.20	0.35	7.28		205	76
270	2.10	0.34	7.12		205	77
275	2.00	0.34	7.17		201	77
280	1.90	0.35	7.19		201	76
285	1.80	0.36	7.07		200	77
290	1.80	0.4	7.1		197	77
295	1.70	0.4	7.07		197	76
300	1.60	0.42	7.14		199	77
305	1.50	0.42	7.06		198	77
310	1.40	0.35	6.7		198	76
315	1.30	0.35	6.59		194	76

320	1.20	0.34	6.54		190	77
325	1.10	0.37	6.53		192	76
330	1.00	0.36	6.46		190	76
335	1.00	0.34	6.58		192	76
340	0.90	0.34	6.36		189	76
345	0.80	0.32	6.49		186	76
350	0.70	0.32	6.75		184	77
355	0.60	0.25	6.75		183	77
360	0.50	0.24	6.63		183	76
365	0.40	0.27	6.75		181	76
370	0.30	0.28	6.75		177	77
375	0.30	0.29	6.75		177	77
380	0.20	0.3	6.68		179	76
385	0.10	0.32	6.61		178	76
390	0.00	0.35	6.71		177	76

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 5

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/25/19

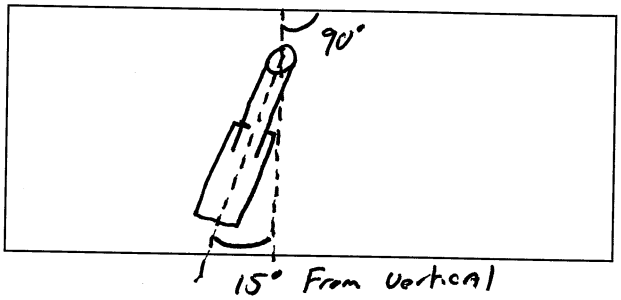
Test Crew: B Davis R Tiegs

OMNI Equipment ID numbers:

Wood Heater Run Notes

Air Control Settings

Primary:



Secondary: fixed

Tertiary/Pilot: NA

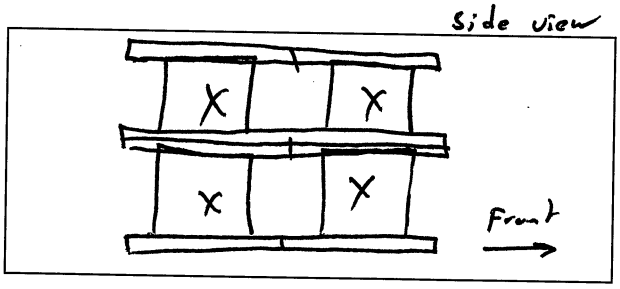
Fan: Not used. FAN Confirmation

Preburn Notes

Time	Notes
30	Raked coals
61	Raked coals

Test Notes

Sketch test fuel configuration:



Start up procedures & Timeline:

Bypass: open until 75 seconds

Fuel loaded by: 75 seconds

Door closed at: 75 seconds

Primary air: At test setting entire test

Notes: FAN not used (FAN Confirmation)

Time	Notes
60	changed Front Filter in train A

Technician Signature: BD Date: 5/2/19

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 5

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 04/25/19

Test Crew: B Davis, R Tiegs

OMNI Equipment ID numbers:

Wood Heater Fuel Data

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

Pre-Burn Fuel

Calibration: Cal Value (1) = 12% Actual Reading 12

Cal Value (2) = 22% Actual Reading 22

Piece:	Length:	Reading:	Piece:	Length:	Reading:
1	72 in	18.7	7	8 in	22.0
2	8 in	18.4	8	8 in	22.3
3	8 in	19.1	9	___ in	___
4	96 in	18.8	10	___ in	___
5	96 in	19.5	11	___ in	___
6	8 in	21.0	12	___ in	___

20.03

Total Pre-Burn Fuel Weight: 29.1 Pre-Burn Fuel Average Moisture: ~~19.18~~ RT

Time (clock): 0826 Room Temperature (F): 69.8 Initials: RT

Test Fuel

Firebox Volume (ft³): 3.25 Test Fuel Piece Length (in): 20"

Load Weight Range (lb): 20.5-25.0 Total Wet Fuel Load Weight (lb): 21.3

4.3 / 5.3

Fuel Type & Amount: 2 x 4: Ø 4 x 4: 4

Weight (with spacers): Ø Weight (with spacers): 21.3

Piece:	Weight (lbs):	Moisture Readings (%DB):				Fuel Type:
1	5.2	20.8	18.7	20.4		4x4
2	5.2	19.5	19.3	21.1		4x4
3	4.3	22.7	19.8	19.4		4x4
4	4.9	22.2	22.6	18.7		4x4
5	___	___	___	___		___
6	___	___	___	___		___
7	___	___	___	___		___

Spacer Moisture Readings (%DB)

10.9	12.0	12.3	13.7	___	___	___	___
10.6	13.2	9.5	8.9	___	___	___	___
12.0	11.5	11.4	12.0	___	___	___	___
11.4	12.9	14.0	12.8	___	___	___	___

Time (clock): 0920 Room Temperature (F): 69.8 Initials: RT

Technician Signature: Date: 4/25/19

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 5

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/25/19

Test Crew: B Daws R Tiggs

OMNI Equipment ID numbers:

Wood Heater Supplemental Data

Start Time: 10:40

Stop Time: 17:10

Booth #: E1

Stack Gas Leak Check:

Initial: good Final: good

Sample Train Leak Check:

A: 0 @ 8 "Hg

B: 0 @ 7 "Hg

Calibrations: Span Gas CO_2: 10.08 CO: 2.53

	Pre Test		Post Test	
	Zero	Span	Zero	Span
Time	1016	1016	542	5:42
CO_2	0.00	10.08	0.00	10.01
CO	0.000	2.529	0.000	2.513

Air Velocity (ft/min): Initial: < 50 Final: <50

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

Pitot Tube Leak Test: Initial: good Final: good

Stack Diameter (in): 8

Induced Draft: 0.0

% Smoke Capture: 100 %

Flue Pipe Cleaned Prior to First Test in Series:

Date: 4/18/19 Initials: BR

	Initial	Middle	Ending
P_b (in/Hg)	30.11		30.04
RH (%)	34.2		33.6
Ambient (°F)	72		76

Tunnel Traverse

Microtector Reading	dP (in H_2O)	T(°F)
	.068	88
	.088	88
	.104	89
	.070	89
	.076	89
	.104	89
	.100	89
	.078	89
Center:		
	.112	88

~~.112~~

Tunnel Static Pressure (in H_2O):	
Beginning of Test	End of Test
-.39	-.39

Background Filter Volume: N/A

Technician Signature:

Date: 5/7/19

Run 6

Wood Heater Test Results - ASTM E2780 / ASTM E2515

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Project No.: 0135WS043E
Tracking No.: 2366
Run: 6
Test Date: 4/26/2019

Burn Rate	**1.26 kg/hr dry**
Average Tunnel Temperature	88 degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	20.05 feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	13519.0 dscf/hour
Average Delta p	0.113 inches H20
Total Time of Test	400 minutes

	AMBIENT	SAMPLE TRAIN 1	SAMPLE TRAIN 2	FIRST HOUR FILTER (TRAIN 1)
Total Sample Volume - Vm	0.000 cubic feet	64.446 cubic feet	64.632 cubic feet	9.550 cubic feet
Average Gas Meter Temperature	74 degrees Fahrenheit	84 degrees Fahrenheit	84 degrees Fahrenheit	83 degrees Fahrenheit
Total Sample Volume (Standard Conditions) - Vmstd	0.000 dscf	64.808 dscf	63.173 dscf	9.616 dscf
Total Particulates - m_n	0 mg	5.1 mg	4.9 mg	1.8 mg
Particulate Concentration (dry-standard) - C_f/C_s	0.000000 grams/dscf	0.00008 grams/dscf	0.00008 grams/dscf	0.00019 grams/dscf
Total Particulate Emissions - E_T	0.00 grams	7.09 grams	6.99 grams	2.53 grams
Particulate Emission Rate	0.00 grams/hour	1.06 grams/hour	1.05 grams/hour	2.53 grams/hour
Emissions Factor		0.84 g/kg	0.83 g/kg	1.07 g/kg
Difference from Average Total Particulate Emissions		0.05 grams	0.05 grams	

Dual Train Comparison Results Are Acceptable

FINAL AVERAGE RESULTS

Complete Test Run	
Total Particulate Emissions - E_T	7.04 grams
Particulate Emission Rate	**1.06 grams/hour**
Emissions Factor	0.84 grams/kg
First Hour Emissions	
Total Particulate Emissions - E_T	2.53 grams
Particulate Emission Rate	2.53 grams/hour
Emissions Factor	1.07 grams/kg

QUALITY CHECKS

Filter Temps < 90 °F	OK
Filter Face Velocity (47 mm)	OK
Dryer Exit Temp < 80F	OK
Leakage Rate	OK
Ambient Temp (55-90°F)	OK
Negative Probe Weight Eval.	OK
Pro-Rate Variation	OK
Stove Surface ΔT	OK
Train Precision 7.5%	0.72
Train Precision 0.5g/kg	0.01

Technician Signature:_____

Wood Heater Preburn Data - ASTM E2780

Run:	**6**
Manufacturer:	Hearth & Home
Model:	Defiant 1975-CAT-C
Tracking No.:	2366
Project No.:	0135WS043E
Test Date:	4/26/2019
Beginning Clock Time:	9:11

Coal Bed Range (lb):	**4.5** (min)	**5.6** (max)

Technician Signature: 

			Temperatures (°F)							
Elapsed Time (min)	Scale (lb)	Stack Draft (in H_2O)	FB Top	FB Bottom	FB Back	FB Left	FB Right	Avg. Firebox Surface	Stack	Ambient
0	12	-0.058	603	317	185	301	418	364.8	419	74
5	11.2	-0.049	561	330	195	313	424	364.6	245	73
10	10.6	-0.05	502	331	193	295	379	340	241	74
15	10	-0.052	455	330	177	265	332	311.8	254	74
20	9.5	-0.052	425	328	179	244	302	295.6	263	74
25	9.1	-0.051	403	326	185	229	281	284.8	263	74
30	8.2	-0.055	433	326	186	221	271	287.4	276	72
35	7.6	-0.052	465	320	192	220	265	292.4	273	74
40	7	-0.054	472	315	199	220	261	293.4	275	72
45	6.5	-0.052	468	310	205	220	258	292.2	278	73
50	6	-0.051	462	307	211	221	256	291.4	272	72
55	5.6	-0.051	464	305	212	222	255	291.6	259	72
60	5.1	-0.051	484	303	207	227	256	295.4	273	73
65	4.9	-0.047	466	298	204	232	254	290.8	248	72
70	4.8	-0.044	431	294	196	235	248	280.8	233	74

Wood Heater Test Fuel Data - ASTM E2780

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 4/26/2019
Run No.: 6

Firebox Volume (ft^3):	3.25
Fuel Piece Length (in):	20
2x4 Crib Weight (lb):	
4x4 Crib Weight (lb):	22.4

Total Fuel Weight (Dry Basis, lb):	18.6	
Fuel Density (lb/ft^3, Dry Basis):	30.45	OK
Loading Density (lb/ft^3, Wet Basis):	6.89	OK
2x4 Percentage:	N/A	N/A

Coal Bed Range (20-25%): **4.48 - 5.6**

Test Fuel Piece	Weight (lb)	Size	Readings (Dry Basis %)			Dry Weight (lb)
1	4.7	4"x 4"	21.7	23.8	21.6	3.84
2	5.2	4"x 4"	18.7	19.9	19.3	4.36
3	5.8	4"x 4"	19.0	23.8	20.8	4.79
4	5.2	4"x 4"	19.1	21.3	23.8	4.28

Spacer Readings (Dry Basis %)			
13.2	11.3		
15.4	11.5		
12.4	12.7		
16.0			
17.5			
15.1			
13.8			
15.3			
13.7			
15.2			
14.8			
16.2			
11.4			

Technician Signature: 

Wood Heater Lab Data - ASTM E2780 / ASTM E2515

Manufacturer:	Hearth & Home	Equipment Numbers:	283A, 637, 592
Model:	Defiant 1975-CAT-C		
Tracking No.:	2366		
Project No.:	0135WS043E		
Run #:	6		
Date:	4/26/2019		

TRAIN 1 (First Hour emissions)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	D752	123.1	121.3	1.8
C. Rear filter catch	Filter				0.0
D. Probe catch*	Probe				0.0
E. Filter seals catch*	Seals				0.0

Sub-Total Total Particulate, mg: 1.8

TRAIN 1 (Post First Hour Change-out)

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
B. Front filter catch	Filter	D753	123.3	121.1	2.2
C. Rear filter catch	Filter	D754	122.6	122.4	0.2
D. Probe catch*	Probe	OES3	114769.9	114769.4	0.5
E. Filter seals catch*	Seals	R774	3326.8	3326.4	0.4

Sub-Total Total Particulate, mg: 3.3

Train 1 Aggregate Total Particulate, mg: **5.1**

TRAIN 2

Sample Component	Reagent	Filter, Probe or Dish #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	D755	124.5	120.7	3.8
B. Rear filter catch	Filter	D756	121.3	121.2	0.1
C. Probe catch*	Probe	8	115594.0	115593.6	0.4
D. Filter seals catch*	Seals	R775	3391.4	3390.8	0.6

Total Particulate, mg: **4.9**

AMBIENT

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

Total Particulate, mg: **0.0**

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

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

Technician Signature: 

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - ASTM E2780 / ASTM E2515

Run: 6

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 4/26/2019
Beginning Clock Time: 10:24

Total Sampling Time: 400 min
Recording Interval: 5 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.022 (1) 0.995 (2) _____ (Amb)

Barometric Pressure:	Begin	Middle	End	Average
	30.28	30.24	30.19	30.24 "Hg

OMNI Equipment Numbers: _____

PM Control Modules: 335, 336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.390 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 20.05 ft/sec.
Initial Tunnel Flow: 222.5 scfm
Average Tunnel Flow: 225.3 scfm
Post-Test Leak Check (1): 0.000 cfm @ 8 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 9 in. Hg
Average Test Piece Fuel Moisture: 21.07 Dry Basis %

Technician Signature: _____

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.080	0.108	0.092	0.076	0.079	0.092	0.100	0.072	0.114	"H2O
Temp:	89	89	88	88	89	89	88	88	88	

V_{strav} 20.13 ft/sec V_{scent} 22.67 ft/sec F_p 0.888

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)											Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface Temp	Catalyst Exit Temp	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
0	0.000	0.000			1.34	75	1.8	1.05	77	1.8	93	0.114			22.4		409	291	191	236	245	274	847	230	71	67	72	69	73	-0.044	6.53	0.18
5	0.793	0.790	0.16	0.16	1.33	75	1.82	1.04	77	1.8	87	0.112	100	100	22.1	-0.3	346	284	185	228	233	255	1029	226	73	71	74	71	73	-0.048	8.34	0.5
10	1.589	1.591	0.16	0.16	1.33	75	1.81	1.09	77	1.8	86	0.113	100	100	21.7	-0.4	308	279	189	211	215	240	1092	239	73	70	74	68	72	-0.049	8.83	0.59
15	2.381	2.399	0.16	0.16	1.32	76	1.8	1.08	77	1.8	87	0.112	100	102	21.4	-0.3	278	273	198	197	200	229	1141	253	73	70	74	67	73	-0.052	9.5	0.56
20	3.174	3.203	0.16	0.16	1.32	77	1.8	1.08	78	1.8	88	0.112	100	101	20.9	-0.5	286	267	209	187	189	228	1192	262	73	70	74	67	73	-0.053	10.52	0.86
25	3.967	4.008	0.16	0.16	1.31	78	1.79	1.07	79	1.8	89	0.114	99	100	20.4	-0.5	294	262	218	181	182	227	1219	270	73	70	74	67	72	-0.056	10.33	0.8
30	4.759	4.812	0.16	0.16	1.32	78	1.8	1.07	79	1.8	90	0.113	100	101	19.9	-0.5	296	258	228	178	178	228	1242	282	73	70	75	68	72	-0.056	10.76	0.72
35	5.556	5.617	0.16	0.16	1.33	79	1.81	1.07	80	1.8	92	0.113	100	101	19.3	-0.6	289	254	238	177	175	227	1266	304	74	71	75	68	73	-0.060	10.77	0.45
40	6.353	6.421	0.16	0.16	1.33	80	1.82	1.07	81	1.8	91	0.111	101	101	18.8	-0.5	280	250	245	177	173	225	1259	297	74	71	75	69	73	-0.058	10.85	0.21
45	7.152	7.226	0.16	0.16	1.33	80	1.82	1.07	81	1.8	93	0.114	100	100	18.2	-0.6	286	247	249	176	172	226	1303	311	74	71	75	69	73	-0.061	11.63	0.61
50	7.951	8.031	0.16	0.16	1.32	81	1.81	1.07	81	1.8	94	0.114	100	100	17.5	-0.7	311	244	258	178	173	233	1313	312	74	71	75	69	73	-0.062	11.76	1.25
55	8.750	8.837	0.16	0.16	1.33	81	1.82	1.07	82	1.8	95	0.113	100	101	16.8	-0.7	330	242	264	183	175	239	1337	324	74	72	76	70	73	-0.064	11.9	1.71
60	9.550	9.643	0.16	0.16	1.33	81	1.82	1.07	82	1.8	95	0.113	100	101	16.1	-0.7	340	240	269	189	177	243	1317	321	75	72	76	70	72	-0.063	11.37	1
65	10.354	10.448	0.16	0.16	1.33	82	1.83	1.07	82	1.8	95	0.113	101	101	15.4	-0.7	351	238	268	194	180	246	1313	319	77	72	76	71	72	-0.063	11.58	1.44
70	11.157	11.254	0.16	0.16	1.34	82	1.84	1.07	83	1.8	95	0.115	100	100	14.7	-0.7	368	236	269	199	182	251	1315	318	76	72	76	71	73	-0.062	11.63	1.51
75	11.961	12.060	0.16	0.16	1.35	82	1.84	1.07	83	1.8	95	0.111	102	102	14.1	-0.6	385	235	269	204	185	256	1308	314	76	73	76	71	74	-0.062	11.61	1.3
80	12.766	12.866	0.16	0.16	1.35	82	1.83	1.07	83	1.8	95	0.112	101	101	13.4	-0.7	387	233	267	210	188	257	1288	317	76	73	76	71	73	-0.061	11.58	1.11
85	13.570	13.673	0.16	0.16	1.35	83	1.84	1.07	83	1.8	95	0.113	101	101	12.8	-0.6	395	232	265	215	190	259	1287	310	76	73	77	72	74	-0.061	11.64	1.18
90	14.376	14.479	0.16	0.16	1.34	83	1.84	1.07	84	1.8	95	0.112	101	101	12.2	-0.6	410	231	265	218	192	263	1295	312	76	73	77	72	74	-0.061	11.77	1.15
95	15.182	15.286	0.16	0.16	1.34	83	1.84	1.07	84	1.8	94	0.114	100	100	11.6	-0.6	416	230	266	222	193	265	1289	308	76	73	77	72	72	-0.061	11.68	1.08
100	15.987	16.093	0.16	0.16	1.34	83	1.83	1.08	84	1.8	94	0.114	100	100	11.0	-0.6	419	229	265	225	195	267	1298	314	76	73	76	72	72	-0.062	11.87	1.2
105	16.793	16.900	0.16	0.16	1.34	83	1.84	1.07	84	1.8	94	0.111	102	101	10.5	-0.5	421	228	267	230	197	269	1278	306	76	73	76	72	72	-0.059	11.66	0.78
110	17.599	17.707	0.16	0.16	1.34	83	1.84	1.07	84	1.8	94	0.111	102	101	9.9	-0.6	418	228	266	235	200	269	1273	306	76	73	76	72	73	-0.058	11.57	0.83
115	18.404	18.515	0.16	0.16	1.34	83	1.83	1.07	84	1.8	94	0.113	101	101	9.4	-0.5	426	228	265	240	202	272	1270	298	76	73	76	72	73	-0.059	11.7	1.1
120	19.210	19.322	0.16	0.16	1.34	84	1.83	1.07	84	1.8	94	0.115	100	100	8.8	-0.6	428	228	263	245	205	274	1255	299	76	73	76	72	73	-0.058	11.27	0.86
125	20.015	20.129	0.16	0.16	1.34	84	1.84	1.07	84	1.8	94	0.112	101	101	8.3	-0.5	431	228	260	249	207	275	1250	296	76	73	77	72	73	-0.057	11.39	0.94
130	20.821	20.936	0.16	0.16	1.34	84	1.83	1.07	85	1.8	93	0.113	101	100	7.8	-0.5	441	228	258	253	210	278	1241	289	76	73	77	72	73	-0.056	11.23	0.9
135	21.627	21.743	0.16	0.16	1.34	84	1.84	1.07	85	1.8	93	0.111	101	101	7.4	-0.4	443	228	256	255	212	279	1251	289	76	73	77	72	74	-0.056	11.11	0.94
140	22.433	22.550	0.16	0.16	1.34	84	1.84	1.08	85	1.8	93	0.113	101	100	7.0	-0.4	451	228	255	257	214	281	1223	288	76	73	77	72	74	-0.056	10.8	0.68
145	23.239	23.359	0.16	0.16	1.34	84	1.84	1.07	85	1.8	92	0.112	101	101	6.6	-0.4	445	228	251	259	216	280	1157	277	77	73	77	72	73	-0.052	10.14	0.49
150	24.046	24.166	0.16	0.16	1.33	84	1.84	1.07	85	1.8	91	0.113	100	100	6.3	-0.3	434	228	243	260	216	276	1101	262	76	72	76	72	74	-0.050	9.71	0.36
155	24.852	24.974	0.16	0.16	1.34	84	1.83	1.07	85	1.8	90	0.113	100	100	6.0	-0.3	421	228	234	260	216	272	1073	257	76	72	76	72	73	-0.049	9.48	0.36
160	25.659	25.783	0.16	0.16	1.34	85	1.83	1.08	85	1.8	90	0.112	101	101	5.7	-0.3	412	228	226	261	216	269	1041	256	76	72	76	72	73	-0.049	9.47	0.33
165	26.466	26.591	0.16	0.16	1.33	85	1.84	1.07	85	1.8	89	0.114	100	100	5.5	-0.2	406	229	219	260	215	266	1018	248	76	72	76	72	74	-0.049	9.2	0.32
170	27.273	27.399	0.16	0.16	1.34	85	1.84	1.08	85	1.8	89	0.113	100	100	5.2	-0.3	401	229	213	260	213	263	1008	244	76	72	76	72	74	-0.047	9.11	0.31
175	28.080	28.208	0.16	0.16	1.33	85	1.83	1.07	85	1.8	88	0.112	100	100	5.0	-0.2	395	229	209	259	213	261	982	240	76	72	76	72	74	-0.047	8.84	0.3
180	28.887	29.017	0.16	0.16	1.34	85	1.84	1.07	85	1.8	88	0.114	100	100	4.8	-0.2	391	229	206	258	212	259	978	237	76	72	76	72	73	-0.046	8.52	0.34
185	29.694	29.826	0.16	0.16	1.34	85	1.84	1.07	85	1.8	87	0.113	100	100	4.6	-0.2	385	229	202	256	210	256	951	236	76	72	76	72	73	-0.045	8.03	0.32

Wood Heater Test Data - ASTM E2780 / ASTM E2515

Run: 6

Manufacturer: Hearth & Home
Model: Defiant 1975-CAT-C
Tracking No.: 2366
Project No.: 0135WS043E
Test Date: 4/26/2019
Beginning Clock Time: 10:24

Total Sampling Time: 400 min
Recording Interval: 5 min
Background Sample Volume: _____ cubic feet

Meter Box Y Factor: 1.022 (1) 0.995 (2) _____ (Amb)

Barometric Pressure:

Begin	Middle	End	Average
30.28	30.24	30.19	30.24 "Hg

OMNI Equipment Numbers: _____

PM Control Modules: 335, 336
Dilution Tunnel MW(dry): 29.00 lb/lb-mole
Dilution Tunnel MW(wet): 28.78 lb/lb-mole
Dilution Tunnel H2O: 2.00 percent
Dilution Tunnel Static: -0.390 "H2O
Tunnel Area: 0.19635 ft2
Pitot Tube Cp: 0.99

Avg. Tunnel Velocity: 20.05 ft/sec.
Initial Tunnel Flow: 222.5 scfm
Average Tunnel Flow: 225.3 scfm
Post-Test Leak Check (1): 0.000 cfm @ 8 in. Hg
Post-Test Leak Check (2): 0.000 cfm @ 9 in. Hg
Average Test Piece Fuel Moisture: 21.07 Dry Basis %

Technician Signature: _____

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	Center	
Initial dP	0.080	0.108	0.092	0.076	0.079	0.092	0.100	0.072	0.114	"H2O
Temp:	89	89	88	88	89	89	88	88	88	

V_{strav} 20.13 ft/sec V_{scent} 22.67 ft/sec F_p 0.888

	Particulate Sampling Data														Fuel Weight (lb)		Temperature Data (°F)												Stack Gas Data		
Elapsed Time (min)	Gas Meter 1 (ft^3)	Gas Meter 2 (ft^3)	Sample Rate 1 (cfm)	Sample Rate 2 (cfm)	Orifice dH 1 ("H_2O)	Meter 1 Temp (°F)	Meter 1 Vacuum ("Hg)	Orifice dH 2 ("H_2O)	Meter 2 Temp (°F)	Meter 2 Vacuum ("Hg)	Dilution Tunnel (°F)	Dilution Tunnel Center dP	Pro. Rate 1	Pro. Rate 2	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Avg. Stove Surface Temp	Catalyst Exit Temp	Stack	Filter 1	Dryer Exit 1	Filter 2	Dryer Exit 2	Ambient	Draft ("H_2O)	CO_2 (%)	CO (%)
190	30.501	30.634	0.16	0.16	1.33	85	1.84	1.07	86	1.8	87	0.114	99	99	4.4	-0.2	381	229	198	253	209	254	930	230	76	72	76	72	74	-0.043	7.95	0.32
195	31.309	31.444	0.16	0.16	1.34	85	1.84	1.07	86	1.8	87	0.114	100	99	4.3	-0.1	375	228	194	249	209	251	914	227	76	71	76	72	73	-0.043	7.76	0.34
200	32.116	32.252	0.16	0.16	1.34	85	1.83	1.07	86	1.8	86	0.115	99	99	4.1	-0.2	369	227	190	245	208	248	905	223	76	71	76	72	73	-0.042	7.73	0.36
205	32.924	33.061	0.16	0.16	1.34	85	1.84	1.07	86	1.8	86	0.113	100	100	4.0	-0.1	365	227	188	242	207	246	913	223	76	71	76	71	74	-0.042	7.66	0.38
210	33.732	33.870	0.16	0.16	1.34	85	1.84	1.07	86	1.8	86	0.113	100	100	3.8	-0.2	362	226	185	239	206	244	912	222	76	71	76	71	73	-0.041	7.52	0.41
215	34.539	34.680	0.16	0.16	1.34	85	1.83	1.07	86	1.8	86	0.112	100	100	3.7	-0.1	359	225	182	235	205	241	906	220	76	71	76	71	74	-0.041	7.46	0.41
220	35.347	35.488	0.16	0.16	1.34	85	1.83	1.07	86	1.8	86	0.113	100	100	3.5	-0.2	356	225	180	232	204	239	892	218	76	71	76	71	74	-0.040	7.4	0.4
225	36.155	36.297	0.16	0.16	1.33	85	1.83	1.08	86	1.8	85	0.114	99	99	3.4	-0.1	352	223	177	229	203	237	884	215	75	71	76	71	73	-0.040	7.28	0.41
230	36.963	37.106	0.16	0.16	1.34	85	1.83	1.08	86	1.8	85	0.113	100	100	3.3	-0.1	348	222	175	226	203	235	875	213	75	71	76	71	74	-0.040	7.16	0.41
235	37.771	37.916	0.16	0.16	1.33	85	1.84	1.07	86	1.8	85	0.113	100	100	3.2	-0.1	343	221	173	223	202	232	868	212	75	71	76	71	74	-0.039	6.94	0.44
240	38.579	38.725	0.16	0.16	1.34	85	1.83	1.07	86	1.8	85	0.114	99	99	3.0	-0.2	338	220	171	220	201	230	865	211	75	71	75	71	74	-0.039	6.85	0.47
245	39.388	39.534	0.16	0.16	1.34	85	1.83	1.08	86	1.8	85	0.112	100	100	2.9	-0.1	332	219	169	217	200	227	854	207	75	71	75	71	75	-0.038	6.57	0.46
250	40.196	40.343	0.16	0.16	1.33	85	1.84	1.07	86	1.8	84	0.114	99	99	2.8	-0.1	326	218	167	214	198	225	841	205	75	71	76	71	75	-0.038	6.47	0.46
255	41.004	41.153	0.16	0.16	1.33	85	1.83	1.07	86	1.8	84	0.114	99	99	2.8	0	322	217	164	212	197	222	829	206	75	71	75	71	74	-0.038	6.5	0.46
260	41.813	41.962	0.16	0.16	1.33	85	1.84	1.07	86	1.8	84	0.113	100	100	2.7	-0.1	319	216	162	210	195	220	814	201	75	70	75	71	74	-0.037	6.42	0.45
265	42.621	42.771	0.16	0.16	1.33	86	1.83	1.07	86	1.8	84	0.112	100	100	2.6	-0.1	315	214	160	207	194	218	807	203	75	70	75	71	74	-0.037	6.29	0.45
270	43.429	43.581	0.16	0.16	1.34	86	1.83	1.08	86	1.8	84	0.113	100	100	2.5	-0.1	312	212	158	206	192	216	799	198	75	70	75	71	74	-0.037	6.2	0.46
275	44.237	44.391	0.16	0.16	1.34	86	1.83	1.07	86	1.8	84	0.113	100	100	2.4	-0.1	310	211	156	204	191	214	791	198	75	70	75	71	74	-0.036	6.26	0.46
280	45.046	45.200	0.16	0.16	1.35	86	1.83	1.07	86	1.8	84	0.115	99	99	2.3	-0.1	308	210	154	202	190	213	783	194	75	70	75	71	74	-0.036	6.06	0.46
285	45.854	46.009	0.16	0.16	1.34	86	1.83	1.08	86	1.8	83	0.113	99	99	2.2	-0.1	306	208	151	201	188	211	776	198	75	70	75	71	74	-0.036	6.09	0.5
290	46.663	46.819	0.16	0.16	1.34	86	1.83	1.07	86	1.8	83	0.113	100	100	2.2	0	306	207	150	199	186	210	780	196	75	70	75	71	74	-0.036	6.15	0.49
295	47.471	47.629	0.16	0.16	1.33	86	1.83	1.08	86	1.8	83	0.113	99	100	2.1	-0.1	305	206	150	198	185	209	759	193	75	70	75	70	75	-0.035	6.53	0.41
300	48.279	48.438	0.16	0.16	1.34	86	1.83	1.07	86	1.8	83	0.115	99	99	2.0	-0.1	302	204	148	196	184	207	746	190	75	70	75	70	74	-0.034	6.4	0.39
305	49.087	49.247	0.16	0.16	1.34	86	1.83	1.07	86	1.8	83	0.115	99	99	1.9	-0.1	301	203	147	194	184	206	744	191	75	70	75	70	74	-0.034	6.28	0.42
310	49.895	50.056	0.16	0.16	1.34	86	1.83	1.07	86	1.8	83	0.115	99	99	1.8	-0.1	299	202	145	192	182	204	745	190	75	70	75	70	74	-0.035	6.18	0.45
315	50.704	50.867	0.16	0.16	1.34	86	1.83	1.07	86	1.8	83	0.112	100	100	1.7	-0.1	297	201	145	191	182	203	753	191	75	70	75	70	74	-0.034	6.17	0.46
320	51.512	51.677	0.16	0.16	1.34	86	1.83	1.07	86	1.8	83	0.113	99	100	1.6	-0.1	297	200	145	189	181	202	757	192	75	70	75	70	74	-0.035	6.28	0.47
325	52.320	52.486	0.16	0.16	1.35	86	1.83	1.07	86	1.8	83	0.112	100	100	1.6	0	296	200	145	188	181	202	755	192	75	70	75	70	74	-0.034	6.11	0.5
330	53.129	53.296	0.16	0.16	1.35	86	1.83	1.07	86	1.8	83	0.111	100	100	1.5	-0.1	296	199	145	187	181	202	756	191	75	70	75	70	74	-0.035	6.14	0.5
335	53.937	54.106	0.16	0.16	1.35	86	1.83	1.07	86	1.8	84	0.112	100	100	1.4	-0.1	295	198	144	186	181	201	754	191	75	70	75	70	74	-0.034	6.68	0.47
340	54.746	54.916	0.16	0.16	1.35	86	1.84	1.07	86	1.8	83	0.114	99	99	1.3	-0.1	296	198	144	186	181	201	754	192	75	70	75	70	74	-0.034	6.4	0.5
345	55.554	55.725	0.16	0.16	1.34	86	1.83	1.07	86	1.8	83	0.112	100	100	1.2	-0.1	295	197	144	185	181	200	756	189	75	70	75	70	74	-0.034	6.25	0.51
350	56.363	56.535	0.16	0.16	1.34	86	1.84	1.08	86	1.8	83	0.113	100	100	1.1	-0.1	294	196	144	185	180	200	751	194	75	70	75	70	74	-0.034	6.16	0.49
355	57.171	57.345	0.16	0.16	1.35	86	1.83	1.08	86	1.8	83	0.114	99	99	1.0	-0.1	293	196	144	185	180	200	749	189	75	70	75	70	74	-0.034	6.8	0.47
360	57.980	58.155	0.16	0.16	1.34	86	1.83	1.07	86	1.8	83	0.113	100	100	0.9	-0.1	292	196	143	184	180	199	739	190	75	70	75	70	74	-0.034	6.59	0.45
365	58.788	58.964	0.16	0.16	1.34	86	1.83	1.07	86	1.8	83	0.112	100	100	0.8	-0.1	292	196	143	183	179	199	743	189	75	70	76	70	74	-0.034	6.86	0.45
370	59.597	59.774	0.16	0.16	1.35	86	1.84	1.07	86	1.8	83	0.115	99	99	0.7	-0.1	291	196	143	182	179	198	747	189	75	70	76	70	74	-0.034	6.94	0.47
375	60.405	60.583	0.16	0.16	1.34	86	1.83	1.07	86	1.8	83	0.113	99	99	0.6	-0.1	292	196	143	183	179	199	743	192	76	70	76	71	75	-0.034	7.16	0.42
380	61.213	61.394	0.16	0.16	1.34	86	1.83	1.07	86	1.8	83	0.111	100	101	0.5	-0.1	296	197	143	184	181	200	713	190	76	70	76	70	75	-0.034	6.7	0.38
385	62.021	62.203	0.16	0.16	1.34	86	1.83	1.07	86	1.8	83	0.112	100	100	0.4	-0.1	299	198	141	185	182	201	699	185	76	70	76	71	75	-0.033	6.49	0.36
390	62.830	63.011	0.16	0.16	1.34	86	1.83	1.07	86	1.8	83	0.112	100	100	0.3	-0.1	302	199	140	186	183	202	688	184	76	70	76	71	75	-0.032	6.27	0.37
395	63.638	63.821	0.16	0.16	1.34	86	1.83	1.07	86	1.8	83	0.113	99	100	0.2	-0.1	303	200	138	187	184	202	684	180	76	70	76	71	75	-0.033	6.13	0.39
400	64.446	64.632	0.16	0.16	1.34	86	1.83	1.07	86	1.8	83	0.114	99	99	0.0	-0.2	309	201	136	187	184	203	676	182	76	70	76	71	75	-0.032	6.91	0.39
Avg/Tot	64.446	64.632	0.16	0.16	1.34	84		1.07	84		88	0.113	100	100								71.0				71	76	71	74	-0.045		

OMNI-Test Laboratories

Manufacturer: Hearth & Home
Model: Defiant
Date: 04/25/19
Run: 5
Control #: 0135WS043E
Test Duration: 400
Output Category: 3

Technicians: _____

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	77.0%	83.2%
Combustion Efficiency	94.3%	94.3%
Heat Transfer Efficiency	82%	88.2%

Output Rate (kJ/h)	19,200	18,214	**(Btu/h)**
Burn Rate (kg/h)	1.26	2.78	**(lb/h)**
Input (kJ/h)	24,945	23,664	**(Btu/h)**

Test Load Weight (dry kg)	8.39	18.50	**dry lb**
MC wet (%)	17.4		
MC dry (%)	21.07		
Particulate (g)	7.04		
CO (g)	675		
Test Duration (h)	6.67		

Emissions	**Particulate**	**CO**
g/MJ Output	0.05	5.28
g/kg Dry Fuel	0.84	80.46
g/h	1.06	101.32
lb/MM Btu Output	0.13	12.26

Air/Fuel Ratio (A/F)	13.45

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

VERSION: 2.2 12/14/2009

Manufacturer:	Hearth & Home	**Appliance Type:**	Cat
Model:	Defiant		
Date:	4/26/2019	**Temp. Units**	F (F or C)
Run:	6	**Weight Units**	lb (kg or lb)
Control #:	0135WS043E		
Test Duration:	400		
Output Category:	3		

		Fuel Data		
			D. Fir	
Wood Moisture (% wet):	17.40	**HHV**	19,810	kj/kg
Load Weight (lb wet):	22.40	**%C**	48.73	
Burn Rate (dry kg/h):	1.26	**%H**	6.87	
Total Particulate Emissions:	7.04 g	**%O**	43.9	
		%ASH	0.5	

Averages	**0.60**	**8.48**	**#DIV/0!**	**238.98**	**73.60**
				Temp. (ºF)	
Elapsed Time (min)	**Fuel Weight Remaining (lb)**	**Flue Gas Composition (%) CO**	**CO_2**	**O_2**	**Flue Gas**	**Room Temp**
0	22.40	0.18	6.53		230	73
5	22.10	0.50	8.34		226	73
10	21.70	0.59	8.83		239	72
15	21.40	0.56	9.50		253	73
20	20.90	0.86	10.52		262	73
25	20.40	0.80	10.33		270	72
30	19.90	0.72	10.76		282	72
35	19.30	0.45	10.77		304	73
40	18.80	0.21	10.85		297	73
45	18.20	0.61	11.63		311	73
50	17.50	1.25	11.76		312	73
55	16.80	1.71	11.90		324	73
60	16.10	1.00	11.37		321	72
65	15.40	1.44	11.58		319	72
70	14.70	1.51	11.63		318	73
75	14.10	1.30	11.61		314	74
80	13.40	1.11	11.58		317	73
85	12.80	1.18	11.64		310	74
90	12.20	1.15	11.77		312	74
95	11.60	1.08	11.68		308	72
100	11.00	1.20	11.87		314	72
105	10.50	0.78	11.66		306	72

110	9.90	0.83	11.57		306	73
115	9.40	1.10	11.70		298	73
120	8.80	0.86	11.27		299	73
125	8.30	0.94	11.39		296	73
130	7.80	0.90	11.23		289	73
135	7.40	0.94	11.11		289	74
140	7.00	0.68	10.80		288	74
145	6.60	0.49	10.14		277	73
150	6.30	0.36	9.71		262	74
155	6.00	0.36	9.48		257	73
160	5.70	0.33	9.47		256	73
165	5.50	0.32	9.20		248	74
170	5.20	0.31	9.11		244	74
175	5.00	0.30	8.84		240	74
180	4.80	0.34	8.52		237	73
185	4.60	0.32	8.03		236	73
190	4.40	0.32	7.95		230	74
195	4.30	0.34	7.76		227	73
200	4.10	0.36	7.73		223	73
205	4.00	0.38	7.66		223	74
210	3.80	0.41	7.52		222	73
215	3.70	0.41	7.46		220	74
220	3.50	0.40	7.40		218	74
225	3.40	0.41	7.28		215	73
230	3.30	0.41	7.16		213	74
235	3.20	0.44	6.94		212	74
240	3.00	0.47	6.85		211	74
245	2.90	0.46	6.57		207	75
250	2.80	0.46	6.47		205	75
255	2.80	0.46	6.5		206	74
260	2.70	0.45	6.42		201	74
265	2.60	0.45	6.29		203	74
270	2.50	0.46	6.2		198	74
275	2.40	0.46	6.26		198	74
280	2.30	0.46	6.06		194	74
285	2.20	0.5	6.09		198	74
290	2.20	0.49	6.15		196	74
295	2.10	0.41	6.53		193	75
300	2.00	0.39	6.4		190	74
305	1.90	0.42	6.28		191	74
310	1.80	0.45	6.18		190	74
315	1.70	0.46	6.17		191	74

320	1.60	0.47	6.28		192	74
325	1.60	0.5	6.11		192	74
330	1.50	0.5	6.14		191	74
335	1.40	0.47	6.68		191	74
340	1.30	0.5	6.4		192	74
345	1.20	0.51	6.25		189	74
350	1.10	0.49	6.16		194	74
355	1.00	0.47	6.8		189	74
360	0.90	0.45	6.59		190	74
365	0.80	0.45	6.86		189	74
370	0.70	0.47	6.94		189	74
375	0.60	0.42	7.16		192	75
380	0.50	0.38	6.7		190	75
385	0.40	0.36	6.49		185	75
390	0.30	0.37	6.27		184	75
395	0.20	0.39	6.13		180	75
400	0.00	0.39	6.91		182	75

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 6

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/26/19

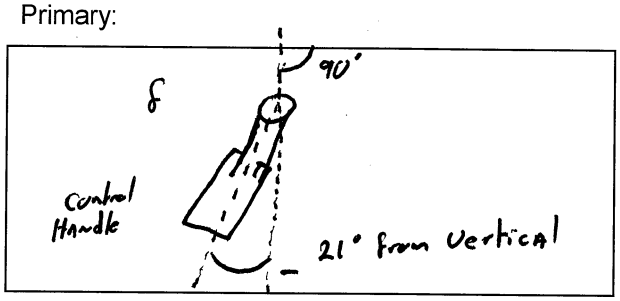
Test Crew: B Davis R Tiggs

OMNI Equipment ID numbers:

Wood Heater Run Notes

Air Control Settings

Primary:



Secondary: fixed

Tertiary/Pilot: NA

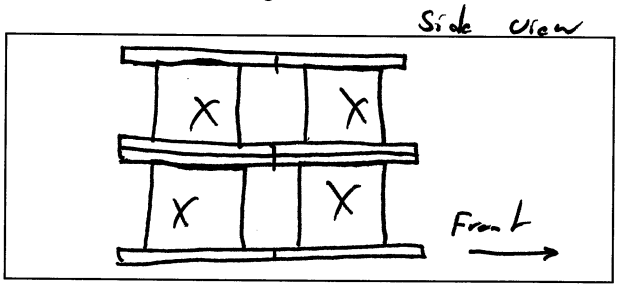
Fan: On High

Preburn Notes

Time	Notes
25	Raked coal bed
56	Raked coal bed

Test Notes

Sketch test fuel configuration:



Start up procedures & Timeline:

Bypass: closed by 60 seconds

Fuel loaded by: 60 seconds

Door closed at: 60 seconds

Primary air: At test setting entire test

Notes: Fan On High entire test

Time	Notes
60	Changed front filter in train A

Technician Signature: Date: 5/7/19

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 6

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/26/19

Test Crew: D Daus R Tiess

OMNI Equipment ID numbers:

Wood Heater Fuel Data

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

Pre-Burn Fuel

Calibration: Cal Value (1) = 12% Actual Reading 12

Cal Value (2) = 22% Actual Reading 22

Piece:	Length:	Reading:	Piece:	Length:	Reading:
1	96 in	19.8	7	____ in	____
2	96 in	20.8	8	____ in	____
3	48 in	22.0	9	____ in	____
4	48 in	21.5	10	____ in	____
5	48 in	22.3	11	____ in	____
6	____ in	____	12	____ in	____

Total Pre-Burn Fuel Weight: 286 Pre-Burn Fuel Average Moisture: 21.28

Time (clock): 0742 Room Temperature (F): 68.9 Initials: BR

Test Fuel

Firebox Volume (ft³): 3.25 Test Fuel Piece Length (in): 20

Load Weight Range (lb): 22.75 (20.5 , 25.0) Total Wet Fuel Load Weight (lb): 22.4 (4.5 - 5.6)

Fuel Type & Amount: 2 x 4: 0 4 x 4: 4

Weight (with spacers): 0 Weight (with spacers): 22.4

Piece:	Weight (lbs):	Moisture Readings (%DB):				Fuel Type:
1	4.7	21.7	23.8	21.6		4x4
2	5.2	18.7	19.9	19.3		4x4
3	5.8	19.0	23.8	20.8		4x4
4	5.2	19.1	21.3	23.8		4x4
5	____	____	____	____		____
6	____	____	____	____		____
7	____	____	____	____		____

Spacer Moisture Readings (%DB)

13.2	17.5	13.7	11.4	____	____	____	____
15.4	15.1	15.2	11.3	____	____	____	____
12.4	13.8	14.8	11.5	____	____	____	____
16.0	15.3	16.2	12.7	____	____	____	____

Time (clock): 0810 Room Temperature (F): 69.4 Initials: BR

Technician Signature: Date: 5/7/19

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 6

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/26/19

Test Crew: B Daus R Tiess

OMNI Equipment ID numbers:

Wood Heater Supplemental Data

Start Time: 10:24 Booth #: E1

Stop Time: 17:04

Stack Gas Leak Check:

Initial: good Final: good

Sample Train Leak Check:

A: 0.0 @ 7 "Hg

B: 0.0 @ 7 "Hg

Calibrations: Span Gas CO_2: 10.08 CO: 2.53

	Pre Test		Post Test	
	Zero	Span	Zero	Span
Time	0949	0949	1715	1715
CO_2	0.00	10.09	0.06	9.98
CO	0.000	2.532	-0.012	2.495

Air Velocity (ft/min): Initial: <50 Final: <50

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

Pitot Tube Leak Test: Initial: good Final: good

Stack Diameter (in): 8

Induced Draft: 0.0

% Smoke Capture: 100%

Flue Pipe Cleaned Prior to First Test in Series:

Date: 4/18/19 Initials: BR

	Initial	Middle	Ending
P_b (in/Hg)	30.28		30.19
RH (%)	43		29
Ambient (°F)	73		75

Tunnel Traverse

Microtector Reading	dP (in H_2O)	T(°F)
	.080	89
	.108	89
	.092	88
	.076	88
1	.079	89
2	.092	89
3	.100	88
4	.072	88
Center:		
	0.114	88

Background Filter Volume: N/A

Tunnel Static Pressure (in H_2O):	
Beginning of Test	End of Test
-.39	-.39

Technician Signature: Date: 5/7/19

Appendix B – Sample Analysis
Laboratory forms
Tare Sheets

Includes:

Run 1
Run 2
Run 3
Run 4
Run 5 (fan confirmation)
Run 6

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 1

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/19/19

Test Crew: D Davis R. Tiggs

OMNI Equipment ID numbers: 283A, 637, 592

ASTM E2515 Lab Sheet

Assembled By:

BDavis

Date/Time in Dessicator:

4/19/19 2220

	Weighing #1	Weighing #2	Weighing #3	Weighing #4	Weighing #5
	Date/Time: 4/23/19 1440	Date/Time: 4/25/19 10:50	Date/Time: 4/26/19 8:15	Date/Time:	Date/Time:
	R/H %: 18.9	R/H %: 21.5	R/H %: 19.5	R/H %:	R/H %:
	Temp: 71.2	Temp: 72.3	Temp: 72.5	Temp:	Temp:
	200 mg Audit: 200.0	200 mg Audit: 200.1	200 mg Audit: 199.9	200 mg Audit:	200 mg Audit:
	2 g Audit: 2000.1	2 g Audit: 2000.5	2 g Audit: 2000.5	2 g Audit:	2 g Audit:
	100 g Audit: 99997.8	100 g Audit 999978	100 g Audit 999978	100 g Audit	100 g Audit
	Initials:	Initials: RT	Initials: RT	Initials:	Initials:

Train	Element	ID #	Tare (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)
A (First Hour)	Front Filter	D725	122.1	123.4	123.1	123.1 ✓		
	Rear Filter							
	Probe							
	O-Ring Set							
A (Remainder)	Front Filter	D726	121.6	125.2	125.0 ✓			
	Rear Filter	D727	120.6	120.9	120.9 ✓			
	Probe	38	1141510	1141516	1141518 ✓			
	O-Ring Set	R763	3355.5	3356.2	3357.0	3356.9 ✓		
B	Front Filter	D728	120.2	124.2	124.2 ✓			
	Rear Filter	D729	121.2	121.8	121.7 ✓			
	Probe	53	1182733	1182739	1182738 ✓			
	O-Ring Set	R764	4112.9	4113.9	4114.2	4114.3 ✓		
BG	Filter							

Technician Signature: [signature] Date: 5/7/19

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 2

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/22/19

Test Crew: DOws

OMNI Equipment ID numbers: 2834, 637, 572

ASTM E2515 Lab Sheet

Assembled By:

DOws

Date/Time in Dessicator:

4/22/19 1645

	Weighing #1	Weighing #2	Weighing #3	Weighing #4	Weighing #5
Date/Time:	4/23/19 1650	4/25/19 11:00	4/26/19	4/29/19	
R/H %:	18.9	21.5	9.5	9.5	
Temp:	71.2	72.3	72.5	71.2	
200 mg Audit:	200.0	200.1	199.9	200.3	
2 g Audit:	2000.1	2000.5	2000.5	2000.2	
100 g Audit	99997.8	99997.9	99997.6	99998.0	
Initials:	BL	RT	RT	RT	

Train	Element	ID #	Tare (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)
A (First Hour)	Front Filter	D745	121.5	124.4	124.0	123.9 ✓		
	Rear Filter							
	Probe	53						
	O-Ring Set							
A (Remainder)	Front Filter	D746	121.8	126.9	126.9 ✓			
	Rear Filter	D747	120.6	120.9	120.5	120.3 ✓		
	Probe	58	117066.0	117067.3	117067.4 ✓			
	O-Ring Set	R765	3319.4	3320.2	3320.8	3320.4	3320.2 ✓	
B	Front Filter	D748	119.9	127.6	127.8 ✓			
	Rear Filter	D749	121.1	121.9	121.7 ✓			
	Probe	62	117661.0	117661.6	117661.9	117661.6	117661.5 ✓	
	O-Ring Set	R766	3346.0	3346.6	3347.4	3347.1	3346.9 ✓	
BG	Filter							

Technician Signature: [signature] Date: 5/7/19

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 3

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/23/19

Test Crew: B Davis, RTiegs

OMNI Equipment ID numbers: 2x34, 637, 592

ASTM E2515 Lab Sheet

Assembled By: B Davis

Date/Time in Dessicator: 4/23/19

	Weighing #1	Weighing #2	Weighing #3	Weighing #4	Weighing #5
Date/Time:	4/25/19 1100	4/26/19 8:20	4/29/19	4/30	
R/H %:	21.5	19.5	9.5	16	
Temp:	72.3	72.5	71.2	71.8	
200 mg Audit:	200.1	199.9	200.3	199.9	
2 g Audit:	2000.5	2000.5	2000.2	2000.3	
100 g Audit:	99997.9	99997.8	99998.0	999979	
Initials:	RT	RT	RT	RT	

Train	Element	ID #	Tare (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)
A (First Hour)	Front Filter	D730	120.9	121.9	121.9✓			
	Rear Filter							
	Probe							
	O-Ring Set							
A (Remainder)	Front Filter	D731	121.1	124.8	125.0✓			
	Rear Filter	D732	120.2	120.7	120.7✓			
	Probe	64	118206.6	118207.3	118207.0	118207.0✓		
	O-Ring Set	R767	3289.4	3290.8	3290.0	3290.0✓		
B	Front Filter	D733	122.0	127.1	126.8	126.7✓		
	Rear Filter	D734	122.0	121.9✓			121.9✓	
	Probe	65	117084.2	117084.7	117084.5✓			
	O-Ring Set	R768	4057.9	4059.6	4059.4✓			
BG	Filter							

Technician Signature: [signature] Date: 5/7/19

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 4

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/24/19

Test Crew: B Davis R Tiege

OMNI Equipment ID numbers: 283A, 637, 592

ASTM E2515 Lab Sheet

Assembled By: B Davis

Date/Time in Dessicator: 4/24/19

	Weighing #1	Weighing #2	Weighing #3	Weighing #4	Weighing #5
Date/Time:	10/26/19 8:45	4/29/19	4/30	4/30	
R/H %:	19.5	9.5	~~9.5~~ 16		
Temp:	72.5	71.2	71.8		
200 mg Audit:	199.9	200.3	199.9		
2 g Audit:	2000.5	2000.2	2000.3		
100 g Audit:	99997.8	99998.0	99997.9		
Initials:	RT	RT	RT		

Train	Element	ID #	Tare (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)
A (First Hour)	Front Filter	D735	120.8	121.7	121.4	121.4 ✓		
	Rear Filter							
	Probe							
	O-Ring Set							
A (Remainder)	Front Filter	D736	120.6	123.2	123.1 ✓			
	Rear Filter	D737	121.5	121.9	121.9 ✓			
	Probe	66	118454.9	118455.4	118455.4 ✓			
	O-Ring Set	R769	32833	3284.2	3283.6	3283.7 ✓		
B	Front Filter	D738	121.2	124.6	124.4 ✓			
	Rear Filter	D739	119.7	120.1	120.0 ✓			
	Probe	67	117759.5	117759.7 ✓	117759.5 ✓			
	O-Ring Set	R770	3549.7	3550.6	3550.1	3550.1 ✓		
BG	Filter							

Technician Signature: _____ Date: 5/7/19

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 5

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/29/19

Test Crew: B Davis, R Tiess

OMNI Equipment ID numbers: 2834, 637, 592

ASTM E2515 Lab Sheet

Assembled By: B Davis

Date/Time in Dessicator: 4/25/19

	Weighing #1	Weighing #2	Weighing #3	Weighing #4	Weighing #5
Date/Time:	4/29/19	4/30	5-1		
R/H %:	9.5	16	8.9		
Temp:	71.2	71.8	73.4		
200 mg Audit:	200.3	199.9	200.0		
2 g Audit:	2000.2	2000.3	2000.4		
100 g Audit:	99998.0	99997.9	99997.9		
Initials:	RT	RT	RT		

Train	Element	ID #	Tare (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)
A (First Hour)	Front Filter	D750	121.5	121.8	121.8 ✓			
	Rear Filter							
	Probe							
	O-Ring Set							
A (Remainder)	Front Filter	D741	121.4	124.8	124.7 ✓			
	Rear Filter	D751	121.2	121.6	121.7 ✓			
	Probe	9	115692.1	115692.6	115692.8 ✓			
	O-Ring Set	R773	3381.4	3382.2	3382.4 ✓			
B	Front Filter	D743	120.8	124.8	124.7 ✓			
	Rear Filter	D744	119.5	119.6 ✓	119.7 ✓			
	Probe	69	117369.4	117370.0	117370.1 ✓			
	O-Ring Set	R772	3620.7	3623.7	3621.7	3621.6 ✓		
BG	Filter							

Technician Signature: [signature] Date: 5/7/19

OMNI-Test Laboratories, Inc. **ASTM E2780 Wood Heater Run Sheets**

Client: Hearth & Home Project Number: 0135WS043E Run Number: 6

Model: Defiant 1975-CAT-C Tracking Number: 2366 Date: 4/26/19

Test Crew: B Davis R Tiggs

OMNI Equipment ID numbers: 283A, 637, 592

ASTM E2515 Lab Sheet

Assembled By:

B Davis

Date/Time in Dessicator:

4/26/19

	Weighing #1	Weighing #2	Weighing #3	Weighing #4	Weighing #5
	Date/Time: 4/30	Date/Time: 5-1	Date/Time: 5/7/19	Date/Time:	Date/Time:
	R/H %: 16.0	R/H %: 8.9	R/H %: 10.5	R/H %:	R/H %:
	Temp: 71.8	Temp: 73.4	Temp: 73.9	Temp:	Temp:
	200 mg Audit: 199.9	200 mg Audit: 200.0	200 mg Audit: 200.0	200 mg Audit:	200 mg Audit:
	2 g Audit: 2000.3	2 g Audit: 2000.4	2 g Audit: 2000.4	2 g Audit:	2 g Audit:
	100 g Audit: 99997.9	100 g Audit 99997.9	100 g Audit 99997.8	100 g Audit	100 g Audit
	Initials: RT	Initials: RT	Initials: DR	Initials:	Initials:

Train	Element	ID #	Tare (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)	Weight (mg)
A (First Hour)	Front Filter	D752	121.3	123.7	123.1	123.1 ✓		
	Rear Filter							
	Probe							
	O-Ring Set							
A (Remainder)	Front Filter	D753	121.1	123.3	123.3 ✓			
	Rear Filter	D754	122.4	122.5	122.6 ✓			
	Probe	OES3	114769.4	114769.9	114769.9 ✓			
	O-Ring Set	R774	3326.4	3327.3	3326.8	3326.8 ✓		
B	Front Filter	D755	120.7	124.5	124.5 ✓			
	Rear Filter	D756	121.2	121.5	121.2	121.3 ✓		
	Probe	8	115593.6	115593.8	115594.0 ✓			
	O-Ring Set	R775	3390.8	3391.5	3391.2	3391.4 ✓		
BG	Filter							

Technician Signature: [signature] Date: 5/7/19

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

Prepared By: BDavis Balance ID #: OMNI-00637 Thermohygrometer ID #: OMNI-00592 Audit Weight ID #/Mass: OMNI-002834 1/200 mg

Placed in Dessicator: Date: 4/16/19 Time: 2:53 ID #	Date: 4/15/19 Time: 0835 RH %: 5.1 T (°F): 68.9 Audit: 200.1	Date: 4/16/19 Time: 1245 RH %: 20.2 T (°F): 70.2 Audit: 200.0	Date: Time: RH %: T (°F): Audit:	Date: Time: RH %: T (°F): Audit:	Date Used	Project Number	Run No.
D725	121.9	122.1	✓		4/19/19	0135WS043E	1
D726	121.6	121.6	✓				
D727	120.8	120.6	✓				
D728	120.1	120.2	✓				
D729	121.2	121.2	✓				
D730	120.8	120.9	✓		4/23/19		3
D731	121.0	121.1	✓				
D732	120.2	120.2	✓				
D733	122.0	122.0	✓				
D734	122.1	1220	✓				
D735	120.7	120.8	✓		4/24/19		4
D736	120.6	120.6	✓				
D737	121.5	121.5	✓				
D738	121.1	121.2	✓				
D739	119.7	119.7	✓				
D740	119.9	119.8	✓		4/25/19		5
D741	121.5	121.4	✓				
D742	120.5	120.5	✓		not used		
D743	120.8	120.8	✓				
D744	119.7	119.5	✓				
	Initials: BA	Initials: BA	Initials:	Initials:			

Final Technician Signature: _____ Date: 4/16/19

Evaluator signature: _____

Control No. P-SFDP-0002.xls, Effective date: 2/1/2017

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

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

Placed in Dessicator: Date: 4/16/19 Time: 2:55 ID #	Date: 4/15/19 Time: 0835 RH %: 5.1 T (°F): 68.9 Audit: 200.1	Date: 4/16/19 Time: 1245 RH %: 20.2 T (°F): 70.2 Audit: 200.0	Date: Time: RH %: T (°F): Audit:	Date: Time: RH %: T (°F): Audit:	Date Used	Project Number	Run No.
D745	121.6	121.5	–		4/22/19	0135-043E	2
D746	121.7	121.8	–				
D747	120.8	120.6	–				
D748	120.0	119.9	–				
D749	121.3	121.1	–				
D750	121.4	121.5	–		4/25/19		5
D751	121.2	121.2	–				5
D752	121.4	121.3	–		4/26/19		6
D753	121.2	121.1	–				
D754	122.5	122.4	–				
D755	120.8	120.7	–				
D756	121.2	121.2	–				
D757	121.1	121.2	–				
D758	121.3	121.4	–				
D759	120.6	120.5	–				
D760	120.9	120.9	–				
D761	121.3	121.2	–				
D762	122.1	121.9	–		5-1		
D763	121.7	121.7	–				
D764	121.0	120.9	–				
	Initials: BA	Initials: BA	Initials:	Initials:			

Final Technician Signature: _____ Date: 4/16/19 Evaluator signature: _____

Control No. P-SFDP-0002.xls, Effective date: 2/1/2017

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

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

Placed in Dessicator: Date: 3/12/19 Time: 0810 ID #	Date: 3/13/19 Time: 10:10 RH %: 11.4 T (°F): 71.2 Audit: 99997.8	Date: 3/15/19 Time: 0850 RH %: 8.4 T (°F): 70.8 Audit: 99997.8	Date: Time: RH %: T (°F): Audit:	Date: Time: RH %: T (°F): Audit:	Date Used	Project Number	Run No.
OES 6	113710.1	113710.1	✓				
6	115349.3	115349.3	✓				
38	114150.8	114151.0	✓		4/19/19	0135WS043 E	1
53	118273.3	118273.3	✓		↓	↓	↓
58	117066.0	117066.0	✓		4/22/19		2
62	117661.0	117661.0	✓		↓		↓
64	118206.4	118206.6	✓		4/23/19		3
65	117084.1	117084.2	✓		↓		↓
66	118454.8	118454.9	✓		4/24/19		4
67	117759.4	117759.5	✓		↓		4
68	116803.9	116804.0	✓		~~4/25/19~~	Not used	~~5~~
69	117369.4	117369.4	✓		↓ 4/25/19	↓	5
	Initials: BR	Initials: BR	Initials:	Initials:			

Final Technician Signature: _____ Date: 3/15/19 Evaluator signature: _____

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

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

Placed in Dessicator: Date: 4/12/19 Time: 0955 ID #	Date: 4/15/19 Time: 0850 RH %: 8.9 T (°F): 69.2 Audit: 99998.0	Date: 4/24/19 Time: 10:36 RH %: 22.2 T (°F): 71.9 Audit: 99997.9	Date: 4-25-19 Time: 10:45 RH %: 21.7 T (°F): 71.8 Audit: 99997.9	Date: 4/30 Time: 9/30 RH %: 111. T (°F): 70.8 Audit: 99997.8	Date Used	Project Number	Run No.
2	115016.7	115015.5	115016.3	115016.9			
OES 3	114769.7	114769.2	114769.4 ✓		4/26/19	0135WS043E	6
4	114858.2	114857.6	114858.1	114857.8 ✓			
8	115594.2	115593.5	115593.6 ✓		4-26	0135WS043E	6
9	115692.3	115692.1	✓		4/25/19	0135WS043E	5
11	114186.0	114185.5	114185.7 ✓				
13	114322.1	114321.6	114321.7 ✓				
15	114341.7	114341.4	114341.9	114341.7 ✓	5-1-19	0135WS043E	3
17	114561.2	114560.8	114560.9 ✓		5-1-19	↓	3
21	114392.1	114391.5	114392.0	114391.8 ✓	~~5~~ 5-6		
22	114343.5	114342.8	114343.3	114342.8	↓		
23	114076.7	114076.1	114076.1 ✓				
25	114299.4	114298.4	114299.3	114298.8	114299.0 ✓		
28	114750.4	114749.2	114750.2	114749.7	114749.9 ✓		
30	114328.2	114327.6	114327.7 ✓				
31	114366.9	114366.5	114366.8	114366.2	114366.4 ✓		
32	114741.3	114740.7	114740.9 ✓				
33	113943.4	113943.0	113943.2 ✓				
56	118613.2	118613.1 ✓	118613.1 ✓				
7	114981.8	114981.1	114981.5	114981.1	114981.3 ✓		
	Initials: BA	Initials: RDT	Initials: RDT	Initials: RDT			

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

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

Prepared By: B Davis Balance ID #: omni-00637 Thermohygrometer ID #: omni-00592 Audit Weight ID #/Mass: omni-002634 1 5g

Placed in Dessicator: Date: 4/12/19 Time: 0920 ID #	Date: 4/13/19 Time: 0920 RH %: 19.4 T (°F): 68.9 Audit: 4999.8	Date: 4/16/19 Time: 12:30 RH %: 20.1 T (°F): 71.6 Audit: 5000.0	Date: Time: RH %: T (°F): Audit:	Date: Time: RH %: T (°F): Audit:	Date Used	Project Number	Run No.
R763	3355.3	3355.5	✓		4/19/19	013540843E	1
R764	4112.7	4112.9	✓		↓	↓	↓
R765	3319.2	3319.4	✓		4/22/19	↓	2
R766	3345.9	3346.0	✓		~~4/22/19~~ ↓	↓	↓
R767	3289.3	3289.4	✓		4/23/19	↓	3
R768	4057.9	4057.9	✓		↓	↓	↓
R769	3283.3	3283.3	✓		4/24/19	↓	4
R770	3549.7	3549.7	✓		↓	↓	↓
R771	3548.6	3548.7	✓		~~4/25/19~~ Not used	↓	~~5~~
R772	3620.6	3620.7	✓		↓	↓	↓ 5
R773	3381.2	3381.4	✓		4/25/19	↓	↓
R774	3326.2	3326.4	✓		4/26/19	↓	6
R775	3390.7	3390.8	✓		↓	↓	↓
R776	3572.7	3572.8	✓				
	Initials: BD	Initials: BD	Initials:	Initials:			

Final Technician Signature: BD Date: 4/16/19 Evaluator signature: Kelly Morgan

Appendix C – Equipment Calibration Data

Equipment for ASTM E2515, ASTM E2780, & EPA Method 28R

ID #	Lab Name/Purpose	Log Name	Attachment Type
132	10 lb Weight	Weight Standard, 10 lb.	Calibration Certificate
185	Platform Scale	Weight Indicator, Model WI-127	Calibration Certificate
283A	Audit Weight Set	Troemer weight set	Calibration Certificate
296-T55	Tape Measure	DeWalt 16' Tape Measure	Calibration Log
335	Sample Box / Dry Gas Meter	Apex Automated Emissions Sampling Box	Calibration Log
336	Sample Box / Dry Gas Meter	Apex Automated Emissions Sampling Box	Calibration Log
420	Combustion Gas Analyzer	CAI Gas Analyzer	See Run Sheet
430	Moisture Meter Calibrator	Delmhorst Moisture Content calibrator	Calibration Certificate
559	Vaneometer	Dwyer Vaneometer	Equipment Record
592	Thermohygrometer	Omega Digital Thermohygrometer	Calibration Log
637	Milligram Balance	Analytical Balance - Mettler - Toledo	Calibration Certificate
650	Barometer/Hygrometer	Digital Barometer	Calibration Certificate

SCALE WEIGHT CALIBRATION DATA SHEET

Weight to be calibrated: 10 pounds

ID Number: OMNI-00132

Standard Calibration Weight: 10 pounds

ID Number: OMNI-00255

Scale Used: MTW-150K

ID Number: OMNI-00353

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

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

*Acceptable tolerance is 1%.

This calibration is traceable to NIST using calibrated standard weights.

Technician signature: _____ Date: 2/23/18

Established 1974

QUALITY CONTROL SERVICES

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

A2LA ACCREDITED
CERTIFICATE #1550.01

OMNI-Test Laboratories, Inc.
13327 NE Airport Way
Portland, OR 97230

Report Number: OMNE0321676181002

A2LA ACCREDITED
CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Scale	Weigh-Tronix	WI-127 1000x0.1lb	21676	185	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
lbs	0.1	QC033	10/2/18	10/4/17	10/2019

FUNCTIONAL CHECKS

SHIFT TEST	LINEARITY	REPEATABILITY	ENVIRONMENTAL CONDITIONS
Test Wt: 500 Tol: 0.5	Test Wt: HB44 Tol: HB44	Test Wt: 200 Tol: 0.2	☐ Good ☑ Fair ☐ Poor
As-Found: Pass:☑ Fail:☐	As-Found: Pass:☑ Fail:☐	As-Found: Pass:☑ Fail:☐	Temperature: 20.2°C
As-Left: Pass:☑ Fail:☐	As-Left: Pass:☑ Fail:☐	As-Left: Pass:☑ Fail:☐	

CALIBRATION DATA

Standard	As-Found	As-Left	Expanded Uncertainty
1000	999.8	999.8	0.12
700	699.8	699.8	0.12
500	499.9	499.9	0.08
200	200.0	200.0	0.08
100	100.0	100.0	0.05
50	50.0	50.0	0.05

CALIBRATION STANDARDS

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

Permanent Information Concerning this Equipment:

Comments/Information Concerning this Calibration

10/2/2018 - Relative Humidity = 61.0 %

Report prepared/reviewed by: _____ **Date:** 10.2.18 **Technician:** D.Oudeans

Signature: _____

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.

Certificate of Calibration

Certificate Number: **685888**

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

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

0723.01
Calibration

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

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

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

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

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

Standards Used

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

Measurement Data

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

Reviewer

3 Issued 10/29/2018 Rev # 15

Inspector

OMNI Environmental Services, Inc.
OMNI-Test Laboratories, Inc.

Tape Measure Calibration Log

Place the calibrated 12" ruler under the tape measure and verify that each ½" (i.e. 1.5", 2", 2.5") between 0 and 36" is within 1/8".

Calibrated using OMNI-00281

Tape Measure Number	Description	Cal Dates				Technician Initials			
OMNI-00296-T55	Dewalt 16' Tape Measure	12/12/16	12/6/17	1/2/19		BR	BR	BR	
OMNI-00296-T56	Dewalt 25' Tape Measure	12/12/16				BR			
OMNI-00296-T59	Dewalt 25' Tape Measures	12/12/16				BR			
OMNI-00296-T58	Dewalt 25' Tape measure	3/9/17	4/3/18			BR	BR		
OMNI-00296-T40	Stanley FatMax Tape measurer 16'	11/17/17	1/2/19			NTS	BR		
OMNI-00296-T31	Stanley Powerlock Tape Measurer	11/22/17	1/2/19			NTS	BR		
OMNI-00296-T59	DeWalt 25' tape Measure	12/06/17	4/3/19			NTS	BR		
OMNI-00296-T54	DeWalt 25' tape Measure	12/06/17				NTS			
OMNI-00296-T56	DeWalt 25' tape Measure	12/06/17				NTS			
OMNI-00296-T55	DeWalt 25' tape Measure	12/06/17	4/3/18	4/3/19		NTS	BR	BR	
OMNI-00296-T47	Removed From Service. Numbers were wearing off.	1/2/19				BR			

Thermal Metering System Calibration
Y Factor

Manufacturer:	APEX
Model:	XC-60-EP
Serial Number:	606001
OMNI Tracking No.:	OMNI-00335
Calibrated Orifice:	☐ Yes

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

Calibration Date:	01/21/19	
Calibrated by:	B. Davis	
Calibration Frequency:	Six months	
Next Calibration Due:	7/21/2019	
Instrument Range:	1.000	cfm
Standard Temp.:	68	oF
Standard Press.:	29.92	"Hg
Barometric Press., Pb:	30.38	"Hg
Signature/Date:		1/21/2019

Previous Calibration Comparision

		Acceptable Deviation (5%)	Deviation
Date	1/17/2018		
y Factor	0.986	0.0493	0.036
Acceptance	Acceptable		

Current Calibration

Acceptable y Deviation	0.020
Maximum y Deviation	0.007
Acceptable dH@ Deviation	N/A
Maximum dH@ Deviation	N/A
Acceptance	Acceptable

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

Calibration Parameters	Run 1	Run 2	Run 3
Reference Meter Pressure ("H2O), Pr	0.00	0.00	0.00
DGM Pressure ("H2O), Pd	2.00	1.38	1.00
Initial Reference Meter	983.3	990.201	995.9
Final Reference Meter	990.109	995.804	1003.2
Initial DGM	0	0	0
Final DGM	6.684	5.539	7.299
Temp. Ref. Meter (°F), Tr	64.7	64.9	65.9
Temperature DGM (°F), Td	73.0	74.0	76.0
Time (min)	34.0	34.5	52.5
Net Volume Ref. Meter, Vr	6.809	5.603	7.300
Net Volume DGM, Vd	6.684	5.539	7.299
Gas Meter y Factor =	**1.028**	**1.024**	**1.015**
Gas Meter y Factor Deviation (from avg.)	0.006	0.002	0.007
Orifice dH@	**N/A**	**N/A**	**N/A**
Orifice dH@ Deviation (from avg.)	N/A	N/A	N/A

where:

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

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

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

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

** Equations come from EPA Method 5

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

DIFFERENTIAL PRESSURE GAUGE CALIBRATION DATA SHEET

Instrument to be calibrated: Pressure Transducer

Maximum Range: 0-2" WC ID Number: OMNI-00335

Calibration Instrument: Digital Manometer ID Number: OMNI-00395

Date: 1/21/19 By: B. Davis

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

Range of Calibration Point ("WC)	Digital Manometer Input ("WC)	Pressure Gauge Response ("WC)	Difference (Input - Response)	% Error of Full Span*
0-20% Max. Range 0 - 0.4	0.070	0.074	0.004	0.2
20-40% Max. Range 0.4 - 0.8	0.620	0.620	0.000	0.0
40-60% Max. Range 0.8 – 1.2	0.980	0.977	0.003	0.15
60-80% Max. Range 1.2 – 1.6	1.277	1.273	0.004	0.2
80-100% Max. Range 1.6 – 2.0	1.716	1.714	0.002	0.1

*Acceptable tolerance is 4%.

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

Technician signature: _____ Date: 1/21/2019

Reviewed by: _____ Date: 2/25/2019

Temperature Calibration
EPA Method 28R, ASTM 2515

Booth:	Temperature Monitor Type:	Equipment Number:
Mobile	National Instruments Logger	00335, 00336

Reference Meter Equipment Number: 00373	Calibration Due Date: 8/02/17

Calibration Performed By:	Date:	Ambient Temperature:	Barometric Pressure:
B. Davis	1/21/19	67	30.38

Input Temperature (F)	Ambient	Meter A	Meter B	Filter A	Filter B	Tunnel	FB Interior
0	Ø	1	Ø	1	Ø	Ø	Ø
100	100	100	100	100	100	100	100
300	300	300	300	300	300	300	300
500	500	500	500	500	500	500	500
700	700	700	700	700	700	700	700
1000	1000	1000	1000	1000	1000	1000	1000

Input (F)	FB Top	FB Bottom	FB Back	FB Left	FB Right	Imp A	Imp B	Cat	Stack
0	Ø	Ø	Ø	Ø	Ø	1	Ø	1	Ø
100	100	100	100	100	100	100	100	100	100
300	300	300	300	300	300	300	300	300	300
500	500	500	500	500	500	500	500	500	500
700	700	700	700	700	700	700	700	700	700
1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

Technician signature: _____ Date: 1/21/19

Reviewed By: _____ Date: 2/25/2019

Thermal Metering System Calibration
Y Factor

Manufacturer:	APEX
Model:	XC-60-EP
Serial Number:	606002
OMNI Tracking No.:	OMNI-00336
Calibrated Orifice:	☐ Yes

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

Calibration Date:	1/21/019	
Calibrated by:	B. Davis	
Calibration Frequency:	Six months	
Next Calibration Due:	7/21/2019	
Instrument Range:	1.000	cfm
Standard Temp.:	68	oF
Standard Press.:	29.92	"Hg
Barometric Press., Pb:	30.38	"Hg
Signature/Date:		1/17/2018

Previous Calibration Comparision

		Acceptable Deviation (5%)	Deviation
Date	1/17/2018		
y Factor	0.985	0.04925	0.010
Acceptance	Acceptable		

Current Calibration

Acceptable y Deviation	0.020
Maximum y Deviation	0.005
Acceptable dH@ Deviation	N/A
Maximum dH@ Deviation	N/A
Acceptance	Acceptable

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

Calibration Parameters	Run 1	Run 2	Run 3
Reference Meter Pressure ("H2O), Pr	0.00	0.00	0.00
DGM Pressure ("H2O), Pd	1.94	1.20	0.80
Initial Reference Meter	6.1	13.7	19.402
Final Reference Meter	13.503	19.3	25
Initial DGM	0	0	0
Final DGM	7.525	5.699	5.746
Temp. Ref. Meter (°F), Tr	67.6	68.3	69.3
Temperature DGM (°F), Td	78.0	79.0	80.0
Time (min)	35.3	32.5	39.5
Net Volume Ref. Meter, Vr	7.403	5.600	5.598
Net Volume DGM, Vd	7.525	5.699	5.746
Gas Meter y Factor =	**0.997**	**0.998**	**0.990**
Gas Meter y Factor Deviation (from avg.)	0.002	0.003	0.005
Orifice dH@	**N/A**	**N/A**	**N/A**
Orifice dH@ Deviation (from avg.)	N/A	N/A	N/A

where:

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

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

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

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

** Equations come from EPA Method 5

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

DIFFERENTIAL PRESSURE GAUGE CALIBRATION DATA SHEET

Instrument to be calibrated: Pressure Transducer

Maximum Range: 0-2" WC ID Number: OMNI-00336

Calibration Instrument: Digital Manometer ID Number: OMNI-00395

Date: 1/21/19 By: B. Davis

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

Range of Calibration Point ("WC)	Digital Manometer Input ("WC)	Pressure Gauge Response ("WC)	Difference (Input - Response)	% Error of Full Span*
0-20% Max. Range 0 - 0.4	0.079	0.078	.001	0.05
20-40% Max. Range 0.4 - 0.8	0.762	0.766	.004	0.2
40-60% Max. Range 0.8 – 1.2	0.943	0.949	.006	0.3
60-80% Max. Range 1.2 – 1.6	1.435	1.440	.005	0.25
80-100% Max. Range 1.6 – 2.0	1.644	1.650	.006	0.3

*Acceptable tolerance is 4%.

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

Technician signature: _____ Date: 1/21/2019

Reviewed by: _____ Date: 2/25/2019

Temperature Calibration
EPA Method 28R, ASTM 2515

Booth:	Temperature Monitor Type:	Equipment Number:
Mobile	National Instruments Logger	00335, 00336

Reference Meter Equipment Number: 00373	Calibration Due Date: 8/02/17

Calibration Performed By:	Date:	Ambient Temperature:	Barometric Pressure:
B. Davis	1/21/19	67	30.38

Input Temperature (F)	Ambient	Meter A	Meter B	Filter A	Filter B	Tunnel	FB Interior
0	Ø	1	Ø	1	Ø	Ø	Ø
100	100	100	100	100	100	100	100
300	300	300	300	300	300	300	300
500	500	500	500	500	500	500	500
700	700	700	700	700	700	700	700
1000	1000	1000	1000	1000	1000	1000	1000

Input (F)	FB Top	FB Bottom	FB Back	FB Left	FB Right	Imp A	Imp B	Cat	Stack
0	Ø	Ø	Ø	Ø	Ø	1	Ø	1	Ø
100	100	100	100	100	100	100	100	100	100
300	300	300	300	300	300	300	300	300	300
500	500	500	500	500	500	500	500	500	500
700	700	700	700	700	700	700	700	700	700
1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

Technician signature: _____ Date: 1/21/19

Reviewed By: _____ Date: 2/25/2019

ZRE NDIR/O_2

USER'S MANUAL

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

Certificate of Calibration

Certificate Number: **675241**

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

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

PO: **180171**
Order Date: **05/10/2018**
Authorized By: **N/A**

Property #: **OMNI-00430**
User: **N/A**
Department: **N/A**
Make: **Delmhorst**
Model: **MCS-1**
Serial #: **OMNI 00430**
Description: **Moisture Calibrator**
Procedure: **Raw Data**
Accuracy: **Raw Data**

Calibrated on: **05/13/2018**
*Recommended Due: **05/13/2019**
Environment: **22** °C **40** % RH
As Received: **Other - See Remarks**
As Returned: **Other - See Remarks**
Action Taken: **Calibrated**
Technician: **40**

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

RECEIVED AND RETURNED WITH POUCH.

Standards Used

Std ID	Manufacturer	Model	Nomenclature	Due Date	Trace ID
281A	Hewlett-Packard	3458A	Digital Bench Multimeter, 8.5	12/11/2018	663526

Measurement Data

Parameter / Measurement Description	Range Unit	Reference	Min	Max	%Error	UUT
Before/After						
Resistance						
12 %	120 MOhm	0.00000	0.0000	0.0000	120.0193	120.0193 MOhm
22 %	1.1 MOhm	0.0000000	0.000000	0.000000	1.100332	1.100332 MOhm

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

Reviewer

Issued 05/14/2018 Rev # 15

Inspector

Calibration Record

Vaneometer Air Velocity Meter OMNI-00559

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

VWR Temperature Hygrometer Calibration Procedure and Data Sheet

Frequency: Every Two Years

Step 1: Locate NIST traceable standard.

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

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

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

Verification Data:

Date: 1/29/19 ~~1/29/19~~ pa Technician: BDavis

Time in desiccate: 0840 Recording time: 1415

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

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

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

Technician Signature: [signature]

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

Certificate of Calibration

Certificate Number: **692254**

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

OnSite

0723.01
Calibration

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

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

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

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

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

Standards Used

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

Measurement Data

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

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

Reviewer

3 Issued 01/14/2019 Rev # 15

Inspector

Certificate of Calibration

Certificate Number: **698278**

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

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

ACCREDITED
0723.01
Calibration

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

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

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

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

Standards Used

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

Measurement Data

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

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

Reviewer

3 Issued 04/19/2019 Rev # 15

Inspector

Appendix D – Example Calculations

Equations and Sample Calculations – ASTM E2780 & E2515

Manufacturer:	Hearth & Home
Model:	Defiant
Run:	1
Category:	II

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

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

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

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

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

BR – Dry burn rate, kg/hr

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

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

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

m_n – Total particulate matter collected, mg

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

E_T – Total particulate emissions, g

PR - Proportional rate variation

PM_R – Particulate emissions for test run, g/hr

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

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 = 10.1 %

M_{Swb} = 1.5 lbs

0.4536 = Conversion factor from lbs to kg

M_{Sdb} = [(1.5 x 0.4536) (100/(100 + 10.1)

M_{Sdb} = **0.6** 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):

MC_{Pnwb} = 4.7

FM_{CPn} = 21.6

= 4.7 (100/(100+ 21.6)

= 3.9 lbs

Total crib weight, excluding spacer 16.38 lbs

M_{Cdb} = **7.43** kg

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

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

Where,

V_C = Volume of fuel crib, ft^3

Sample calculation:

V_C = 980 in^3

1728 = conversion from in^3 to ft^3

D_{Cdb} = 16.38 / 980 * 1728

= **28.88** 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:

$$M_{FTAdb} = 0.62 + 7.43$$

$$= \mathbf{8.05} \text{ kg}$$

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

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

Where,

θ = Total length of test run, min

Sample Calculation:

M_{Bdb} = 8.05 kg

θ = 595 min

$$BR = \frac{60 \times 8.05}{595}$$

BR = **0.81** kg/hr

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

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

Where:

F_p	=	Adjustment factor for center of tunnel pitot tube placement, Fp = $\frac{V_{strav}}{V_{scent}}$, ASTM E2515 Equation (1)
v_{scent}	=	Dilution tunnel velocity calculated after the multi-point pitot traverse at the center, ft/sec
v_{strav}	=	Dilution tunnel velocity calculated after the multi-point pitot traverse, ft/sec
k_p	=	Pitot tube constant, 85.49
C_p	=	Pitot tube coefficient: 0.99, unitless
ΔP*	=	Velocity pressure in the dilution tunnel, in H_2O
T_s	=	Absolute average gas temperature in the dilution tunnel, °R; (°R = °F + 460)
P_s	=	Absolute average gas static pressure in dilution tunnel, = P_{bar} + P_g , in Hg
P_{bar}	=	Barometric pressure at test site, in. Hg
P_g	=	Static pressure of tunnel, in. H_20; (in Hg = in H_20/13.6)
M_s	=	**The dilution tunnel wet molecular weight; M_s = 28.78 assuming a dry weight of 29 lb/lb-mole

Sample calculation:

$$Fp = \frac{13.26}{14.46} = 0.918$$

$$V_s = 0.918 \times 85.49 \times 0.99 \times 0.217 \times \left(\frac{81.9 + 460}{\left(30.03 + \frac{-0.19}{13.6}\right) \times 28.78} \right)^{1/2}$$

V_s = **13.37** ft/s

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

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

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

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

Where:

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

Sample calculation:

$$Q_{sd} = 3600 \times (1 - 0.02) \times 13.37 \times 0.196 \times \frac{528}{81.9 + 460} \times \frac{30 + \frac{-0.19}{13.6}}{29.92}$$

Q_{sd} = **9054.1** dscf/hr

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

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

Where:

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

Sample Calculation:

Using equation for Train 1:

$$V_{m(std)} = 17.64 \times 96.123 \times 1.022 \times \frac{\left(30.03 + \frac{1.33}{13.6}\right)}{(81.9 + 460)}$$

$V_{m(std)}$ = **96.327** dscf

Using equation for Train 2:

$$V_{m(std)} = 17.64 \times 96.087 \times 0.995 \times \frac{\left(30.03 + \frac{1.06}{13.6}\right)}{(82.9 + 460)}$$

$V_{m(std)}$ = **93.516** dscf

Using equation for ambient train:

$$V_{m(std)} = 17.64 \times 0.00 \times 0 \times \frac{\left(\underline{30.03} + \frac{0.00}{13.6}\right)}{(70.8 + 460)}$$

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

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

$$m_n = m_p + m_f + m_g$$

Where:

m_p = mass of particulate matter from probe, mg

m_f = mass of particulate matter from filters, mg

m_g = mass of particulate matter from filter seals, mg

Sample Calculation:

Using equation for Train 1 (first hour):

m_n = 0.0 + 1.0 + 0.0

m_n = 1.0 mg

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

m_n = 0.8 + 3.7 + 1.4

m_n = 5.9 mg

Train 1 aggregate:

m_n = 1.0 + 5.9

m_n = **6.9** mg

Using equation for Train 2:

m_n = 0.5 + 4.5 + 1.4

m_n = **6.4** mg

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

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

Where:

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

Sample calculation:

For Train 1:

$$C_s = 0.001 \times \frac{6.9}{96.33}$$

C_s = **0.00007** g/dscf

For Train 2

$$C_s = 0.001 \times \frac{6.4}{93.52}$$

C_s = **0.00007** g/dscf

For Ambient Train

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

C_r = **0** g/dscf

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

$$E_T = (C_s - C_r) \times Q_{std} \times \theta$$

Where:

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

Sample calculation:

For Train 1

E_T = (0.000072 - 0) x 9054.1 x 595 /60

E_T = 6.43 g

For Train 2

E_T = (0.000068 - 0) x 9054.1 x 595 /60

E_T = 6.14 g

Average

E = 6.29 g

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

7.5% of the average =	0.47
Train 1 difference =	0.14
Train 2 difference =	0.14

PR - Proportional Rate Variation
ASTM E2515 equation (16)

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

Where:

θ = Total sampling time, min

θ_i = Length of recording interval, min

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

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

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

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

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

T_m = Absolute average dry gas meter temperature, ^oR

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

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

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

$$PR = \left(\frac{595 \times 0.794 \times 13.37 \times (91.0 + 460) \times (81.9 + 460)}{5 \times 96.12 \times 13.16 \times (81.9 + 460) \times (76.0 + 460)} \right) \times 100$$

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 (Dual train average) = 6.29 g

θ = 595 min

$PM_R = 60$ x (6.29 / 595)

PM_R = **0.63** g/hr

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

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

Sample Calculation:

E_T (Dual train average) = 6.29 g

M_{Bdb} = 8.05 kg

PM_F = 6.29 / 8.05

PM_F = **0.78** g/kg

Appendix E – Conditioning Data, Manufacturer's Written Instructions

CAT

Stove Name: Defc FB 2020 **Test Date:** 02/13/19 **Run #:** 1

Dilution Tunnel ∪ Factor: ∪ Barometer Start: ∪ End: ∪ in. hg.

PM Train 1	Pre-Test	Post-Test	24 hr	Final
Date / Time	9:30 AM	6:00 PM		6:00 AM
Probe #Q	.9442	.9442		.9442 g.
Filters #Q	.2321	.2362		.2362 g.
Gas Meter	792.650	952.750	O-Ring Residue =	g.

PM Train 2	Pre-Test	Post-Test	24 hr	Final
Probe				g.
Filters				g.
Gas Meter			O-Ring Residue =	g.

PM Emission Rate-

WET: .23 **g/hr**

Date: 02/14

FINAL: .123 **g/hr**

Date: 02/18

BURN RATE-

.82 **kg/hr**

666 min's

DT - 100° 263°

163°

PRE-TEST FUEL LOAD Kindling Weight: 2.72 kg

# of 2 x 4's: 31 # of 4 x 4's: X Length ='s: 8 In.

31.8 lbs Weight: 14.42 kg. Placed on: 1.46 kg. Coal Bed @ Record #: ∪

use 31.5 Air Setting Moved to: Closed at 4.54 kg. (10 lbs) Coal Bed @ Record #: 0

NOTES: Fan on / off Low

TEST FUEL LOAD

Stove Volume: 3.25 Cu. Ft. X 3.17 kg./Cu. Ft. = 10.363 kg.

Length: 20 In. # of 2 x 4's: X # of 4 x 4's: 4 # of Spacers: 12

Fuel Moisture

Rear 2x4 20.1 **Rear 4x4** 20.1 **Front 2x4** 19.1 **Front 4x4** 19.1

M.C. Dry = 100 / (100 / M.C. Wet – 1) M.C. Wet = 100 x M.C. Dry / (100 + M.C. Dry)

Moisture Content: 19.75 % Dry Basis

Actual Fuel Weight: 10.92 kg. (Wet) (4.85 lbs) x 0.20 = 2.184 kg. (Low End Coal Bed Target)

x 0.25 = 2.73 kg. (High End Coal Bed Target) (6 lbs)

Initial: D.W.

NOTES:

Prime-Air Closed (wired shut)

15/64th hole (uncontrolled Air)

Prototypes | DefCFB2020 | 2/13/2019 | 1 | DefCFB20201902131

Results Table = Prototypes
Filename = DefCFB20201902131
Test Stand B Cat-Installed. Air closed.(Wired Shut.)Fan on low.
P0-(kg)- Started pre-burn.

Tunnel B Factor = 0.93
Avg Tun Flow (scfm) 144.4

	Pre-Test	Post-Test	Meter 1 Factor= 0.99					Stove
Probe 1	0.9442	0.9442						
Filters 1	0.2321	0.2362						
O-Ring Residue =		0	Catch (mg)	Meter Temp (deg F)	Meter Volume (scf)	PM Conc (mg/scf)	PM Rate 1 (g/hr)	
Gas Meter 1	792.65	952.75	4.1	91.1	151.86	0.027	0.23	5G

			Meter 2 Factor= 0.944					
Probe 2	0	0						
Filters 2	0	0						
O-Ring Residue =		0	Catch (mg)	Meter Temp (deg F)	Meter Volume (scf)	PM Conc (mg/scf)	PM Rate 2 (g/hr)	
Gas Meter 2	0	0	0	78.9	0	0	0	5G

Time	11:07 AM	10:14 PM		Test Elapsed Time =	666	min
Record #	67	733		Dry Burn Rate =	0.82	kg/hr
Barometer	29.92	29.92	in Hg	Avg PM Rate =	0.23	g/hr
Lab Temp	74	74	deg F	Avg PM Factor =	0.28	g/kg
Avg Stove	263	163	deg F	EPA Avg A/F	22.4	
				Stove Delta T =	-100	deg F
				H.C. Factor =	0	g/kg as CH4
				CO Factor =	6	g/kg
				TCC Efficiency =	67.1	%
				Comb. Efficiency =	99.1	%
				Avg Stack T =	308.9	deg F

EPA Cat. 1

Wet Wood (kg)	Wood Moisture (dry %)	Coal Bed (kg)	Dry Wood (kg)
10.92	19.75	2.63	9.12

Avg Stack Gasses (Ambient Corrected)

Avg CO	0.0207	Vol %
Avg CO2	4.084	Vol %
Avg O2	16.832	Vol %
Avg HC	0	Vol % as CH4
Avg TCC	0.0404	Vol % as CO2

Vermont Castings Group, Bethel **EMISSIONS TEST RESULTS REPORT** Results Table: Prototypes

Stove Name: DefCFB2020 Test Date: 2/13/2019 Run #: 1 File: DefCFB2020190 Record # Start 67 Stop 733

Test Time	666	min
Wet Wood	10.92	kg
Moisture	19.75	dry %
Dry Wood	9.12	kg
Coal Bed	2.63	kg
Stove DeltaT	-100	deg F
Tunnel CD	0.93	

Avg Stack Gasses (amb Corrected)

CO 0.0207 %
CO2 4.084 %
O2 16.832 %
HC 0 % as CH4
TCC 0.0404 % as CO2

PM Trains - EPA 5G-3

	Catch mg	Vol scf	Tun Flow scfm	PM Rate 5g	Prec. %
Train 1	4.10	151.86	144.4	.23	n/a
Train 2	0	0		0	

Average Rate 5G 0.23 g/hr (5g)

Results

PM g/hr (5g)	PM g/kg (5g)	Dry Burn Rate kg/hr	EPA Cat.	EPA A/F	TCC Efficiency	CO g/kg	HC g/kg (CH4)
0.23	**0.28**	**0.82**	**1**	**22.4**	**67.1**	**6.0**	**0**

Heat Output **10,500** Btu/hr (measured efficiency)

Real Time Data*

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %
0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	0.00	0.00	0.0	0.000	0.0	0.00	0	0.0	0.0	0.0
5	5	210	390	421	212	305	308	1202	75	79	79	375	0.309	4.26	-4.26	21.0	0.011	-0.1	-0.10	0	91.5	92.2	100.0
10	10	191	380	397	232	308	302	1387	74	76	76	410	0.330	4.08	0.34	21.0	0.012	-0.1	-0.09	0	91.0	92.2	0.0
15	15	182	362	377	262	314	300	1256	75	75	75	401	0.316	3.92	0.32	21.0	0.011	-0.1	-0.07	0	91.5	91.7	100.0
20	20	117	354	352	276	320	284	1199	70	76	76	422	0.311	3.72	0.34	21.0	0.011	-0.1	-0.07	0	91.0	92.2	100.0
25	25	124	350	346	292	324	287	1281	77	77	81	426	0.344	3.42	0.46	21.0	0.012	-0.1	-0.06	0	91.4	92.2	0.0
30	30	111	325	329	320	320	281	1320	75	73	75	433	0.339	3.20	0.47	21.0	0.012	0.0	-0.06	0	90.2	92.2	0.0
35	35	121	330	319	337	322	286	1337	76	78	74	419	0.323	3.04	0.34	21.0	0.013	0.0	-0.05	0	90.2	91.7	0.0
40	40	115	320	314	340	320	282	1275	79	79	79	390	0.291	2.95	0.22	21.0	0.012	0.0	-0.03	0	90.2	90.3	0.0
45	45	117	316	313	335	322	281	1189	79	70	75	374	0.278	2.90	0.12	21.0	0.011	0.0	-0.04	0	90.9	91.7	100.0
50	50	110	309	307	324	322	274	1080	79	79	79	350	0.258	2.83	0.10	20.9	0.012	0.0	-0.03	0	90.8	92.2	100.0
55	55	111	314	309	311	324	274	1142	83	79	79	353	0.249	2.72	0.14	21.0	0.012	0.0	4.89	0	91.4	16.0	0.0
60	60	113	302	304	300	315	267	1034	74	81	76	331	0.245	2.68	0.06	15.7	0.027	5.2	5.19	4	18.7	18.6	99.4
65	65	105	307	307	292	314	265	1002	77	77	77	324	0.233	2.68	0.04	16.2	0.037	4.8	5.29	7	19.9	18.3	98.9
67	0	105	305	307	288	307	263	961	81	75	77	314	0.224	2.63	0.07	16.4	0.040	4.5	6.31	9	20.8	15.7	98.7
72	5	104	298	298	274	307	256	987	77	81	79	335	0.252	13.45	-10.77	16.6	0.039	4.4	5.19	8	21.3	18.4	98.9
77	10	100	292	285	274	294	249	1035	77	79	79	333	0.263	13.33	0.18	16.0	0.040	4.9	6.07	8	19.4	16.2	98.9
82	15	96	266	264	268	290	237	1054	77	79	79	344	0.269	13.22	-1.27	15.7	0.038	5.2	7.00	6	18.5	14.5	99.1
87	20	98	255	252	270	289	233	1121	79	76	83	354	0.274	13.06	0.25	15.4	0.042	5.5	7.08	7	17.9	14.3	98.9
92	25	96	246	242	275	281	228	1107	77	79	77	357	0.274	12.95	0.25	15.4	0.028	5.6	7.36	4	17.6	13.9	99.4
97	30	91	235	239	276	283	225	1125	78	76	72	361	0.277	12.81	0.25	15.8	0.023	5.2	7.04	4	18.8	14.4	99.5
102	35	97	234	228	282	284	225	1157	78	80	73	362	0.282	12.68	0.25	16.3	0.020	4.6	7.56	2	20.4	13.6	99.7
107	40	92	229	227	290	266	221	1194	77	79	77	368	0.286	12.54	0.25	16.4	0.024	4.6	7.81	5	20.6	13.1	99.3
112	45	89	220	224	296	274	220	1211	78	78	76	372	0.287	12.38	0.23	16.4	0.032	4.5	8.04	6	20.9	12.8	99.1
117	50	91	217	219	295	263	217	1205	76	82	74	373	0.290	12.22	0.27	16.4	0.029	4.5	7.95	6	20.8	12.9	99.1

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %
122	55	94	218	222	296	265	219	1201	79	79	74	372	0.287	12.09	0.25	16.5	0.022	4.4	8.24	4	21.1	12.5	99.4
127	60	99	217	217	289	260	217	1203	76	80	74	369	0.283	11.90	0.30	16.4	0.027	4.5	8.46	4	20.8	12.3	99.4
132	65	95	211	218	291	259	215	1197	78	76	76	365	0.281	11.79	0.25	16.3	0.027	4.6	7.73	4	20.6	13.3	99.4
137	70	94	210	220	290	259	215	1198	79	79	79	370	0.284	11.59	0.29	16.5	0.029	4.4	7.94	5	21.2	13.0	99.2
142	75	98	209	222	300	257	217	1245	74	76	76	378	0.289	11.43	0.34	16.4	0.041	4.5	7.96	9	20.8	12.8	98.7
147	80	94	216	221	296	251	216	1275	77	77	73	379	0.293	11.25	0.31	16.5	0.048	4.5	7.87	11	20.9	12.8	98.4
152	85	96	210	227	297	253	217	1279	79	81	77	386	0.296	11.07	0.31	16.3	0.052	4.6	8.32	11	20.6	12.2	98.4
157	90	91	211	228	296	259	217	1286	76	76	78	383	0.301	10.86	0.34	16.3	0.053	4.6	8.27	11	20.3	12.2	98.4
162	95	99	216	225	312	249	220	1312	77	77	79	392	0.305	10.68	0.34	16.1	0.051	4.8	8.92	10	20.0	11.5	98.5
167	100	96	205	229	300	253	217	1339	85	77	77	405	0.316	10.48	0.36	15.8	0.056	5.1	9.97	11	18.8	10.5	98.4
172	105	96	214	227	314	251	220	1394	77	79	75	420	0.325	10.25	0.41	14.8	0.050	6.2	12.03	8	16.3	9.1	98.8
177	110	96	209	231	326	248	222	1432	77	79	81	428	0.334	10.02	0.41	14.7	0.046	6.3	12.62	8	16.1	8.7	98.9
182	115	97	219	243	342	249	230	1454	80	78	78	436	0.340	9.77	0.43	14.6	0.055	6.4	13.73	9	15.9	8.1	98.7
187	120	102	209	242	348	244	229	1496	77	81	83	454	0.346	9.52	0.43	14.1	0.042	6.8	13.23	6	15.1	8.4	99.1
192	125	98	220	244	359	242	232	1496	74	81	79	454	0.347	9.27	0.46	14.0	0.060	6.9	16.85	9	14.9	6.7	98.7
197	130	92	219	247	366	247	234	1463	80	80	84	451	0.346	9.05	0.43	14.2	0.061	6.7	15.02	9	15.2	7.4	98.7
202	135	103	223	255	372	253	241	1469	83	77	77	455	0.349	8.80	0.43	14.1	0.032	6.8	13.38	4	15.1	8.3	99.4
207	140	104	226	255	374	244	241	1472	70	83	81	452	0.348	8.62	0.38	14.0	0.030	7.0	12.78	4	14.8	8.7	99.5
212	145	105	225	266	379	251	245	1465	82	77	80	455	0.346	8.39	0.39	14.0	0.028	6.9	13.45	4	14.8	8.3	99.5
217	150	105	227	262	377	251	244	1460	81	81	81	450	0.345	8.19	0.36	14.0	0.025	6.9	13.73	3	14.9	8.1	99.6
222	155	103	237	269	378	245	246	1457	80	80	82	453	0.345	7.96	0.38	14.2	0.026	6.7	13.33	4	15.2	8.3	99.4
227	160	101	240	271	382	249	249	1458	77	82	82	447	0.344	7.73	0.41	14.3	0.026	6.7	12.91	3	15.4	8.6	99.5
232	165	111	242	275	381	260	254	1450	77	77	84	446	0.345	7.53	0.38	13.9	0.035	7.0	13.52	5	14.7	8.2	99.3
237	170	105	244	281	381	246	251	1451	79	79	81	450	0.345	7.30	0.39	14.1	0.042	6.8	14.46	6	15.0	7.7	99.1
242	175	103	260	279	384	247	254	1456	79	82	82	455	0.344	7.12	0.39	13.9	0.040	7.0	14.21	6	14.6	7.9	99.2
247	180	106	257	289	387	257	259	1436	80	85	80	450	0.339	6.92	0.36	14.0	0.038	6.9	13.62	5	14.8	8.2	99.3
252	185	108	258	289	380	250	257	1429	80	82	80	441	0.334	6.71	0.36	14.1	0.026	6.9	12.73	4	14.9	8.7	99.5
257	190	104	265	291	380	245	257	1442	80	80	82	441	0.331	6.53	0.34	14.1	0.029	6.8	12.51	3	15.1	8.8	99.5
262	195	108	263	295	384	250	260	1427	82	82	82	432	0.326	6.35	0.32	14.3	0.022	6.6	12.12	3	15.4	9.1	99.6
267	200	112	265	302	374	254	261	1393	78	82	78	426	0.316	6.21	0.30	14.5	0.015	6.4	10.31	2	15.8	10.4	99.8
272	205	110	269	304	371	245	260	1363	76	82	80	412	0.311	6.08	0.27	14.8	0.014	6.2	10.57	2	16.4	10.3	99.7
277	210	110	269	304	367	250	260	1349	80	82	78	404	0.311	5.94	0.25	15.4	0.012	5.6	10.63	2	17.8	10.2	99.8
282	215	108	269	306	354	248	257	1330	80	80	78	395	0.301	5.78	0.25	15.5	0.015	5.5	9.64	2	18.0	11.1	99.6
287	220	114	278	308	356	239	259	1332	80	78	80	397	0.301	5.65	0.25	15.5	0.015	5.5	10.71	2	18.0	10.1	99.6
292	225	107	273	314	345	243	256	1323	78	78	75	395	0.296	5.51	0.25	15.4	0.021	5.5	10.38	3	17.8	10.4	99.6
297	230	110	274	309	352	248	259	1280	76	81	74	387	0.287	5.40	0.22	15.5	0.024	5.4	9.14	4	18.1	11.7	99.5
302	235	105	278	312	341	249	257	1234	78	80	78	373	0.277	5.28	0.18	15.9	0.011	5.0	8.70	1	19.4	12.2	99.9
307	240	107	279	310	327	243	253	1204	77	80	77	368	0.270	5.22	0.15	16.4	0.008	4.5	8.35	1	20.9	12.6	99.8
312	245	116	282	306	326	245	255	1162	80	78	80	356	0.261	5.12	0.14	16.9	0.021	4.1	7.24	5	22.7	14.1	99.3
317	250	118	288	314	310	251	256	1109	77	79	73	349	0.251	5.06	0.13	16.9	0.015	4.0	7.15	3	22.9	14.2	99.6
322	255	110	285	319	298	252	253	1084	80	78	80	337	0.242	4.99	0.11	16.9	0.020	4.0	6.58	5	22.8	15.3	99.3
327	260	106	283	311	289	250	248	1057	79	81	79	326	0.238	4.92	0.11	16.8	0.016	4.1	7.13	2	22.4	14.3	99.7
332	265	112	285	311	285	254	249	1034	78	80	80	324	0.228	4.85	0.12	17.2	0.017	3.8	7.34	4	24.0	13.9	99.4
337	270	110	284	306	271	247	243	980	80	80	78	314	0.219	4.83	0.07	17.3	0.015	3.6	6.35	2	24.8	15.7	99.7
342	275	109	283	307	257	242	240	951	77	79	77	307	0.215	4.78	0.07	17.5	0.018	3.5	7.02	4	25.3	14.5	99.4
347	280	113	285	302	261	246	241	929	81	79	81	302	0.209	4.76	0.05	17.6	0.019	3.4	6.11	4	25.9	16.2	99.4
352	285	114	276	302	250	243	237	914	78	82	80	295	0.203	4.72	0.06	17.6	0.018	3.3	6.79	5	26.2	14.8	99.3

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %
357	290	111	281	292	231	244	232	890	77	77	77	283	0.202	4.69	0.07	17.6	0.017	3.3	7.05	5	26.3	14.4	99.3
362	295	106	269	295	228	241	228	879	74	78	76	293	0.197	4.67	0.05	17.7	0.012	3.2	6.81	2	26.6	14.8	99.8
367	300	108	267	293	228	243	228	875	82	78	80	286	0.195	4.65	0.02	17.7	0.012	3.2	7.19	4	26.7	14.1	99.5
372	305	106	268	296	222	235	225	863	76	76	79	285	0.189	4.60	0.07	17.6	0.011	3.3	6.37	3	26.2	15.6	99.6
377	310	99	267	288	221	236	222	846	78	80	75	286	0.191	4.56	0.07	17.5	0.016	3.4	7.20	4	25.7	14.1	99.5
382	315	101	262	281	214	238	219	837	75	79	77	279	0.185	4.54	0.06	17.6	0.012	3.3	6.86	4	26.0	14.6	99.4
387	320	104	259	274	212	231	216	830	72	77	77	272	0.185	4.49	0.09	17.5	0.012	3.4	7.24	2	25.4	14.0	99.7
392	325	102	259	277	207	229	215	828	79	77	75	272	0.179	4.49	0.05	17.6	0.018	3.3	6.83	5	25.8	14.7	99.3
397	330	102	259	272	202	233	213	819	78	76	74	265	0.176	4.44	0.05	17.6	0.016	3.3	7.45	3	26.2	13.7	99.5
402	335	98	255	270	203	227	211	818	73	79	77	266	0.178	4.42	0.05	17.6	0.017	3.3	7.38	3	26.2	13.8	99.5
407	340	101	253	273	199	227	211	818	77	79	79	271	0.173	4.38	0.06	17.6	0.017	3.4	7.39	3	26.0	13.8	99.5
412	345	102	253	270	201	229	211	811	77	79	72	263	0.174	4.35	0.05	17.5	0.017	3.4	7.49	5	25.6	13.6	99.3
417	350	100	250	272	194	218	207	803	74	79	72	263	0.171	4.33	0.07	17.5	0.018	3.4	7.66	2	25.4	13.3	99.6
422	355	102	244	259	197	225	205	791	79	77	72	261	0.168	4.31	0.04	17.5	0.016	3.4	7.61	4	25.4	13.4	99.4
427	360	107	238	260	190	223	203	795	77	81	77	257	0.169	4.26	0.05	17.4	0.020	3.5	7.34	5	25.2	13.8	99.3
432	365	106	241	256	189	222	203	784	76	74	74	259	0.165	4.22	0.07	17.6	0.018	3.3	7.38	4	26.1	13.7	99.5
437	370	108	244	255	188	224	204	782	77	79	77	263	0.162	4.22	0.04	17.7	0.017	3.3	6.91	4	26.3	14.5	99.5
442	375	105	244	255	188	218	202	783	79	75	79	257	0.164	4.17	0.05	17.5	0.021	3.4	7.40	5	25.5	13.7	99.3
447	380	102	242	255	183	218	200	776	74	79	77	257	0.162	4.15	0.05	17.6	0.020	3.3	7.16	5	26.1	14.0	99.3
452	385	100	242	248	188	220	200	778	81	79	75	255	0.159	4.13	0.04	17.7	0.017	3.3	6.71	4	26.3	14.8	99.4
457	390	104	240	251	188	220	201	782	79	79	77	259	0.159	4.08	0.07	17.8	0.017	3.1	7.49	3	27.0	13.5	99.5
462	395	103	234	252	181	215	197	786	78	76	74	254	0.157	4.06	0.04	17.7	0.021	3.2	7.28	5	26.7	13.9	99.2
467	400	99	236	243	183	211	194	779	74	78	76	247	0.156	4.04	0.06	17.8	0.022	3.2	7.52	6	26.9	13.5	99.2
472	405	97	241	239	187	211	195	792	76	76	78	254	0.161	4.01	0.05	17.7	0.025	3.2	7.59	7	26.6	13.4	99.0
477	410	104	235	237	183	211	194	792	76	74	72	252	0.158	3.99	0.05	17.8	0.025	3.1	7.08	7	27.0	14.2	99.0
482	415	100	233	235	188	211	193	784	76	74	76	252	0.159	3.95	0.04	17.7	0.019	3.2	7.59	6	26.6	13.4	99.2
487	420	97	243	235	181	213	194	782	76	80	80	254	0.160	3.92	0.05	17.8	0.022	3.2	7.35	5	26.8	13.7	99.3
492	425	96	238	232	176	208	190	781	79	77	77	253	0.154	3.90	0.05	17.7	0.025	3.2	6.93	7	26.4	14.4	99.0
497	430	105	243	230	178	208	193	775	78	76	74	250	0.155	3.85	0.05	17.7	0.024	3.2	7.21	7	26.6	13.9	99.0
502	435	100	233	237	175	213	191	772	72	76	76	254	0.151	3.85	0.03	17.8	0.027	3.2	7.08	7	26.7	14.1	99.0
507	440	99	232	234	181	213	192	775	74	76	76	245	0.155	3.81	0.04	17.7	0.025	3.3	6.93	6	26.2	14.4	99.2
512	445	99	232	227	173	208	188	768	73	75	77	249	0.151	3.79	0.04	17.6	0.031	3.3	6.88	10	26.0	14.5	98.5
517	450	104	233	226	179	207	190	819	76	80	78	252	0.159	3.74	0.07	17.7	0.031	3.2	7.12	9	26.5	14.0	98.7
522	455	103	232	225	176	201	187	835	71	77	77	256	0.160	3.72	0.04	17.7	0.034	3.2	6.90	10	26.6	14.4	98.6
527	460	99	230	226	183	198	187	834	76	78	74	258	0.164	3.67	0.07	17.6	0.034	3.3	7.22	10	26.0	13.8	98.6
532	465	96	220	210	175	205	181	841	77	77	77	255	0.164	3.65	0.07	17.6	0.036	3.3	7.03	10	26.0	14.2	98.5
537	470	110	226	228	180	206	190	840	76	80	76	260	0.166	3.63	0.04	17.6	0.034	3.3	6.85	10	25.9	14.5	98.5
542	475	105	229	223	180	201	188	829	73	79	75	258	0.166	3.58	0.07	17.7	0.035	3.3	6.95	10	26.2	14.3	98.5
547	480	105	218	218	182	201	185	829	75	75	77	257	0.165	3.58	0.05	17.6	0.041	3.3	6.75	12	26.0	14.6	98.2
552	485	94	219	217	184	204	184	827	75	75	77	258	0.165	3.54	0.04	17.6	0.035	3.3	6.67	10	25.9	14.8	98.5
557	490	105	226	215	185	200	186	827	74	71	71	258	0.164	3.51	0.05	17.7	0.034	3.2	7.13	10	26.6	14.0	98.5
562	495	103	227	212	180	208	186	827	71	77	71	257	0.165	3.47	0.07	17.7	0.034	3.2	7.22	10	26.3	13.8	98.6
567	500	98	216	210	180	210	183	812	75	77	75	255	0.162	3.45	0.06	17.7	0.035	3.2	6.44	10	26.7	15.3	98.5
572	505	94	220	216	179	201	182	812	75	75	75	253	0.161	3.42	0.07	17.7	0.034	3.2	6.67	11	26.5	14.8	98.5
577	510	95	213	211	177	196	178	805	74	72	76	254	0.161	3.40	0.05	17.7	0.036	3.2	7.04	10	26.3	14.1	98.5
582	515	96	216	210	173	199	179	802	73	75	77	251	0.161	3.36	0.09	17.7	0.037	3.2	6.71	11	26.4	14.7	98.4
587	520	96	216	210	178	197	179	795	71	77	73	247	0.161	3.36	0.04	17.7	0.040	3.2	6.58	12	26.3	14.9	98.3

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %
592	525	102	220	212	175	199	182	789	73	75	70	251	0.158	3.31	0.05	17.7	0.035	3.2	6.71	10	26.4	14.7	98.5
597	530	92	210	214	171	199	177	785	75	75	73	251	0.159	3.27	0.06	17.8	0.036	3.1	6.46	11	27.0	15.2	98.4
602	535	99	210	210	167	195	176	781	75	79	71	242	0.155	3.27	0.04	17.8	0.036	3.1	6.16	10	26.9	15.8	98.5
607	540	98	220	214	175	205	182	774	76	74	74	250	0.155	3.22	0.07	17.8	0.039	3.1	6.41	11	27.1	15.2	98.3
612	545	87	209	211	170	200	175	767	76	78	76	243	0.151	3.20	0.07	17.9	0.039	3.1	6.17	12	27.2	15.6	98.3
617	550	104	211	209	168	196	177	763	74	74	74	239	0.150	3.17	0.07	17.8	0.042	3.1	5.76	13	27.2	16.6	98.2
622	555	98	211	205	170	198	177	757	76	76	70	242	0.150	3.15	0.05	17.9	0.037	3.0	5.65	12	27.8	16.9	98.3
627	560	94	209	209	164	203	176	753	74	77	72	240	0.149	3.13	0.04	17.9	0.043	3.0	5.85	13	27.7	16.3	98.1
632	565	95	205	205	166	192	173	751	74	74	74	239	0.145	3.11	0.04	18.2	0.040	2.8	5.68	12	29.1	16.7	98.2
637	570	98	205	205	162	195	173	745	77	75	73	240	0.146	3.08	0.05	18.1	0.043	2.8	5.68	14	28.6	16.8	98.0
642	575	98	203	203	164	194	172	747	74	74	74	242	0.147	3.06	0.05	18.2	0.033	2.7	5.79	10	29.4	16.5	98.6
647	580	95	211	202	159	194	172	734	76	76	72	237	0.145	3.04	0.04	18.2	0.034	2.7	5.84	12	29.7	16.3	98.2
652	585	97	198	207	168	192	172	727	76	74	76	237	0.144	3.04	0.02	18.2	0.032	2.7	5.47	11	29.6	17.2	98.4
657	590	96	205	203	166	194	173	717	75	75	75	233	0.141	2.97	0.05	18.3	0.034	2.7	5.29	11	29.9	17.7	98.4
662	595	98	203	205	162	194	172	707	74	74	70	231	0.139	2.97	0.05	18.3	0.036	2.6	5.26	12	30.1	17.7	98.3
667	600	97	200	202	157	194	170	700	74	76	76	230	0.136	2.97	0.02	18.3	0.034	2.6	5.12	12	30.4	18.1	98.3
672	605	93	200	202	159	191	169	687	74	72	74	226	0.135	2.93	0.04	18.4	0.031	2.5	5.02	11	30.9	18.4	98.5
677	610	102	197	201	158	192	170	682	73	75	75	229	0.134	2.90	0.03	18.3	0.036	2.6	4.92	13	30.4	18.6	98.0
682	615	94	188	201	154	188	165	679	73	79	75	223	0.133	2.88	0.02	18.4	0.034	2.5	5.54	12	31.0	16.9	98.2
687	620	93	192	200	159	185	166	700	76	74	76	228	0.136	2.86	0.04	18.0	0.039	2.9	5.99	12	28.3	16.0	98.3
692	625	87	186	203	156	190	164	690	79	72	77	229	0.136	2.83	0.05	18.0	0.040	3.0	5.84	13	27.8	16.3	98.2
697	630	94	193	197	154	184	164	625	81	75	77	221	0.125	2.81	0.02	17.9	0.033	3.0	5.50	9	27.9	17.3	98.6
702	635	98	188	207	145	186	165	615	74	74	74	220	0.121	2.77	0.06	18.2	0.028	2.8	5.38	9	29.1	17.5	98.7
707	640	96	191	206	150	186	166	601	77	75	75	214	0.119	2.77	0.02	18.2	0.032	2.8	5.26	11	29.1	17.8	98.4
712	645	95	181	211	149	185	164	598	74	74	76	211	0.112	2.72	0.05	18.2	0.028	2.7	5.23	10	29.7	18.0	98.6
717	650	92	186	210	145	186	164	584	73	71	71	212	0.110	2.72	0.02	18.2	0.029	2.8	5.29	9	29.1	17.8	98.7
722	655	92	184	208	147	182	163	580	77	79	75	208	0.107	2.68	0.04	18.3	0.028	2.7	5.44	9	29.9	17.4	98.7
727	660	96	182	212	143	184	164	558	77	75	75	203	0.101	2.68	0.02	18.2	0.031	2.7	5.35	10	29.3	17.7	98.6
732	665	93	183	213	140	177	161	545	76	74	74	198	0.098	2.65	0.03	18.1	0.027	2.8	5.41	8	29.0	17.6	98.8
733	666	93	185	217	142	179	163	540	74	74	76	194	0.095	2.63	0.07	18.1	0.027	2.8	5.41	8	29.0	17.6	98.8

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %

* Real time data is presented at 5 minute intervals. Average values appearing in this report are based on more frequent measurements

Notes:

Results Table = Prototypes
Filename = DefCFB20201902131
Test Stand B Cat-Installed. Air closed.(Wired Shut.)Fan on low.
P0-(kg)- Started pre-burn.
P20-(3.72kg)- Stir.
P50-(2.81kg)- Stir.
P53-(2.74kg)- Draft set.Analyzers on.
P65-(2.68kg)- Leveled and packed coal bed.
67-(2.63kg)- Doors and damper closed after loading.Air closed,not touched.Fan on low.

CAT

Stove Name: Defiant CFD202 **Test Date:** 02/14/19 **Run #:** 1

Dilution Tunnel U Factor: U Barometer Start: U End: U in. hg.

PM Train 1	Pre-Test	Post-Test	24 hr	Final
Date / Time	7:20 AM	6:30am		6:00AM
Probe #I	.9227	.9221		.9227 g.
Filters #I	.2321	.2347		.2347 g.
Gas Meter	952.8	1074.0	O-Ring Residue =	g.

PM Train 2	Pre-Test	Post-Test	24 hr	Final
Probe				g.
Filters				g.
Gas Meter			O-Ring Residue =	g.

PM Emission Rate-

WET: .20 g/hr

Date: 02/15

FINAL: .20 g/hr

Date: 02/18

BURN RATE-

.93 kg/hr

PRE-TEST FUEL LOAD Kindling Weight: 2.72 kg

499 mins

# of 2 x 4's: 31 # of 4 x 4's: X Length ='s: 8 In.

DT -740

31.3 lbs Weight: 14.20 kg. Placed on: 1.46 kg. Coal Bed @ Record #: U

10 lbs

Air Setting Moved to: Closed at 4.54 kg. Coal Bed @ Record #: 0

2430

1690

NOTES: Fan (on) / off Low

TEST FUEL LOAD

Stove Volume: 3.25 Cu. Ft. X 3.17 kg./Cu. Ft. = 10,363 kg.

Length: 20 In. # of 2 x 4's: X # of 4 x 4's: 4 # of Spacers: 12

Fuel Moisture

Rear 2x4 22. **Rear 4x4** 20.6 **Front 2x4** 22.2 **Front 4x4** 22.

M.C. Dry = 100 / (100 / M.C. Wet – 1)

M.C. Wet = 100 x M.C. Dry / (100 + M.C. Dry)

Moisture Content: 21.7 % Dry Basis

4.15 lbs

Actual Fuel Weight: 9.46 kg. (Wet) x 0.20 = 1.892 kg. (Low End Coal Bed Target)

x 0.25 = 2.365 kg. (High End Coal Bed Target)

5.20 lbs

NOTES: **Initial :** D.W.

No Changes from 02/13/19 TEST

Prototypes | DefCFB2020 | 2/14/2019 | 1 | DefCFB20201902141

Results Table = Prototypes
Filename = DefCFB20201902141
Test Stand B No changes to stove. Cat-Installed. Air wired close.Fan on low.
P0-(kg)- Started pre-burn.

Tunnel B Factor = 0.93
Avg Tun Flow (scfm) 145.2

Meter 1 Factor= 0.99

	Pre-Test	Post-Test	Catch (mg)	Meter Temp (deg F)	Meter Volume (scf)	PM Conc (mg/scf)	PM Rate 1 (g/hr)	Stove
Probe 1	0.9227	0.9227						
Filters 1	0.2321	0.2347						
O-Ring Residue =		0						
Gas Meter 1	952.8	1074	2.6	91.7	114.83	0.023	0.2	5G

Meter 2 Factor= 0.944

			Catch (mg)	Meter Temp (deg F)	Meter Volume (scf)	PM Conc (mg/scf)	PM Rate 2 (g/hr)	
Probe 2	0	0						
Filters 2	0	0						
O-Ring Residue =		0						
Gas Meter 2	0	0	0	79.2	0	0	0	5G

Time	10:26 AM	6:46 PM			
Record #	99	598			
Barometer	29.92	29.92	in Hg		
Lab Temp	74	72	deg F		
Avg Stove	243	169	deg F		

Test Elapsed Time =	499	min
Dry Burn Rate =	0.93	kg/hr
Avg PM Rate =	0.2	g/hr
Avg PM Factor =	0.21	g/kg
EPA Avg A/F	21	
Stove Delta T =	-74	deg F
H.C. Factor =	0	g/kg as CH4
CO Factor =	6	g/kg
TCC Efficiency =	66.6	%
Comb. Efficiency =	99.1	%
Avg Stack T =	330.2	deg F

EPA Cat. 1

Wet Wood (kg)	Wood Moisture (dry %)	Coal Bed (kg)	Dry Wood (kg)
9.46	21.7	2.22	7.77

Avg Stack Gasses (Ambient Corrected)

Avg CO	0.0224	Vol %
Avg CO2	4.451	Vol %
Avg O2	16.498	Vol %
Avg HC	0	Vol % as CH4
Avg TCC	0.044	Vol % as CO2

Vermont Castings Group, Bethel **EMISSIONS TEST RESULTS REPORT** Results Table: Prototypes

Stove Name: DefCFB2020 Test Date: 2/14/2019 Run #: 1 File: DefCFB2020190 Record # Start 99 Stop 598

Test Time	499	min
Wet Wood	9.46	kg
Moisture	21.7	dry %
Dry Wood	7.77	kg
Coal Bed	2.22	kg
Stove DeltaT	-74	deg F
Tunnel CD	0.93	

Avg Stack Gasses (amb Corrected)

CO 0.0224 %
CO2 4.451 %
O2 16.498 %
HC 0 % as CH4
TCC 0.044 % as CO2

PM Trains - EPA 5G-3

	Catch mg	Vol scf	Tun Flow scfm	PM Rate 5g	Prec. %
Train 1	2.60	114.83	145.2	.20	n/a
Train 2	0	0		0	

Average Rate 5G 0.20 g/hr (5g)

Results

PM g/hr (5g)	PM g/kg (5g)	Dry Burn Rate kg/hr	EPA Cat.	EPA A/F	TCC Efficiency	CO g/kg	HC g/kg (CH4)
0.20	**0.21**	**0.93**	**1**	**21.0**	**66.6**	**6.0**	**0**

Heat Output **11,900** Btu/hr (measured efficiency)

Real Time Data*

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %
0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	0.00	0.00	0.0	0.000	0.0	0.00	0	0.0	0.0	0.0
5	5	114	399	366	228	406	302	1169	73	73	78	403	0.331	4.26	-4.26	20.3	0.011	0.6	0.61	0	91.4	92.2	100.0
10	10	108	385	363	237	400	299	1226	78	78	78	393	0.316	4.04	0.43	20.3	0.011	0.6	0.61	-91	91.5	92.1	0.0
15	15	104	374	343	252	396	294	1199	78	76	76	387	0.304	3.90	0.32	20.3	0.012	0.6	0.61	-395	91.4	92.2	0.0
20	20	102	359	341	265	385	290	1203	76	76	79	383	0.295	3.74	0.30	20.3	0.011	0.6	0.61	0	91.4	92.2	100.0
25	25	104	348	326	278	380	287	1176	78	78	74	374	0.281	3.65	0.23	20.3	0.011	0.6	0.60	0	91.0	92.2	100.0
30	30	98	338	312	273	370	278	1248	75	77	77	379	0.292	3.47	0.27	20.3	0.012	0.6	0.59	-91	91.4	92.2	0.0
35	35	98	323	312	290	368	278	1231	77	77	79	381	0.285	3.31	0.43	20.3	0.011	0.6	0.60	0	89.7	91.1	100.0
40	40	100	318	305	283	361	273	1220	77	79	72	368	0.281	3.17	0.25	20.3	0.011	0.6	0.59	-85	91.4	92.2	0.0
45	45	91	311	291	291	348	266	1230	76	74	78	369	0.279	3.06	0.23	20.3	0.011	0.6	0.58	0	90.4	91.9	100.0
50	50	98	311	287	296	341	267	1239	76	76	79	372	0.278	2.95	0.20	20.4	0.011	0.6	0.58	0	91.4	92.1	100.0
55	55	103	303	290	299	334	266	1258	77	77	77	373	0.279	2.79	0.25	20.3	0.011	0.6	0.57	-237	91.1	92.2	0.0
60	60	100	302	285	300	335	265	1199	81	72	74	368	0.271	2.68	0.31	20.4	0.011	0.6	0.57	0	91.4	92.2	100.0
65	65	92	292	285	296	329	259	1166	72	79	75	359	0.262	2.59	0.18	20.4	0.011	0.6	0.57	0	91.4	92.2	100.0
70	70	98	281	283	296	325	257	1140	81	79	79	349	0.255	2.52	0.16	20.4	0.010	0.6	0.56	237	91.6	92.2	0.0
75	75	100	287	283	290	320	256	1084	75	81	75	329	0.237	2.45	0.14	20.4	0.011	0.6	0.55	-49	89.8	91.9	0.0
80	80	96	290	286	277	327	255	1087	79	81	79	349	0.242	2.36	0.16	20.4	0.012	0.6	0.55	49	89.8	91.3	0.0
85	85	105	284	286	273	319	253	1013	78	75	78	323	0.224	2.31	0.14	14.6	0.037	6.3	6.41	5	15.8	15.6	99.3
90	90	98	286	284	260	307	247	978	77	79	77	310	0.214	2.29	0.07	15.5	0.036	5.4	6.57	5	17.8	15.2	99.2
95	95	98	288	281	251	305	245	940	77	81	79	307	0.204	2.27	0.04	15.8	0.042	5.1	6.56	7	18.7	15.2	99.0
99	0	98	283	283	251	305	244	907	81	75	77	296	0.201	2.22	0.07	18.0	0.063	2.9	5.55	20	27.9	17.4	97.1
104	5	99	273	273	249	299	238	1089	73	79	79	331	0.250	11.54	-9.27	14.7	0.073	6.2	9.79	12	16.0	10.8	98.3
109	10	92	270	259	255	290	233	1148	72	79	70	344	0.260	11.41	0.22	14.4	0.075	6.5	8.63	12	15.4	12.1	98.3
114	15	91	258	248	263	291	230	1182	80	76	80	354	0.268	11.25	0.25	14.4	0.067	6.5	9.14	10	15.5	11.6	98.5
119	20	92	240	238	266	288	225	1242	80	77	77	364	0.276	11.11	0.25	14.5	0.047	6.4	7.59	7	15.6	13.6	99.0

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %
124	25	88	240	238	286	286	228	1269	77	80	82	368	0.280	10.93	0.29	14.7	0.049	6.3	7.00	7	15.9	14.4	99.0
129	30	92	234	234	290	277	225	1277	83	79	79	383	0.288	10.77	0.30	14.9	0.042	6.0	7.36	6	16.5	13.8	99.1
134	35	88	232	232	292	279	225	1294	79	77	77	384	0.294	10.59	0.32	15.0	0.052	5.9	7.37	8	16.7	13.7	98.8
139	40	85	229	233	294	276	223	1303	79	74	79	389	0.298	10.43	0.32	15.2	0.056	5.7	7.69	9	17.0	13.2	98.7
144	45	89	227	231	300	274	224	1312	75	79	83	392	0.303	10.25	0.32	15.9	0.044	5.0	7.94	8	19.0	12.9	98.9
149	50	88	223	236	314	275	227	1311	77	80	77	401	0.306	10.05	0.34	15.8	0.044	5.1	8.20	8	18.9	12.5	98.9
154	55	92	223	233	311	277	227	1323	77	85	79	396	0.307	9.86	0.34	15.8	0.044	5.1	8.48	8	18.8	12.1	98.8
159	60	94	221	234	318	268	227	1333	77	81	77	396	0.307	9.66	0.36	15.8	0.047	5.2	8.73	8	18.7	11.9	98.8
164	65	94	218	242	311	272	228	1348	83	81	79	405	0.308	9.46	0.36	15.4	0.055	5.5	9.50	10	17.9	11.1	98.6
169	70	92	227	240	322	275	231	1369	81	77	77	407	0.315	9.25	0.34	15.4	0.057	5.5	9.98	10	17.7	10.7	98.6
174	75	88	219	249	331	269	231	1386	80	77	80	412	0.317	9.02	0.37	15.0	0.063	5.9	10.52	10	16.7	10.2	98.5
179	80	87	218	257	335	261	232	1390	73	79	81	420	0.317	8.78	0.40	15.1	0.057	5.8	10.89	8	17.0	9.9	98.8
184	85	88	221	256	338	267	234	1410	80	82	78	421	0.322	8.59	0.41	15.3	0.051	5.7	10.94	8	17.4	9.9	98.8
189	90	91	224	252	334	269	234	1433	78	82	80	423	0.326	8.39	0.36	15.1	0.044	5.9	11.90	7	16.9	9.2	99.0
194	95	97	231	263	345	267	241	1463	83	80	85	439	0.334	8.16	0.37	14.7	0.059	6.2	13.62	9	16.2	8.1	98.7
199	100	90	228	260	354	267	240	1484	84	82	78	449	0.346	7.91	0.43	14.5	0.076	6.4	15.06	12	15.8	7.4	98.2
204	105	102	226	276	365	267	247	1482	80	80	82	452	0.349	7.66	0.44	14.1	0.100	6.8	15.56	15	14.9	7.2	97.8
209	110	94	231	283	375	257	248	1479	75	79	77	457	0.348	7.44	0.43	13.9	0.086	7.0	16.59	13	14.6	6.7	98.2
214	115	100	236	277	377	257	249	1473	81	83	79	451	0.340	7.21	0.41	14.1	0.040	6.8	14.26	5	15.0	7.8	99.3
219	120	97	236	290	373	264	252	1467	80	82	82	445	0.339	7.01	0.38	14.1	0.026	6.8	13.78	3	15.0	8.1	99.5
224	125	94	238	299	375	273	256	1465	82	82	82	444	0.337	6.83	0.34	14.0	0.022	6.9	14.43	2	14.8	7.7	99.6
229	130	100	241	300	376	263	256	1427	83	83	81	443	0.335	6.62	0.34	14.3	0.020	6.6	10.10	2	15.4	10.7	99.8
234	135	97	250	298	384	263	258	1421	82	85	85	436	0.332	6.42	0.36	14.4	0.027	6.5	11.14	3	15.6	9.7	99.5
239	140	102	263	306	371	263	261	1412	80	82	76	443	0.330	6.24	0.34	14.4	0.030	6.6	11.50	4	15.4	9.5	99.5
244	145	99	263	304	380	271	263	1412	82	82	82	443	0.330	6.03	0.34	14.4	0.033	6.6	12.56	4	15.4	8.8	99.4
249	150	95	262	310	375	265	261	1420	80	82	80	447	0.332	5.85	0.34	14.2	0.040	6.7	12.59	5	15.2	8.7	99.2
254	155	97	259	304	378	276	263	1425	78	80	76	447	0.334	5.62	0.39	14.0	0.037	6.9	11.00	5	14.7	9.9	99.3
259	160	97	269	308	382	259	263	1427	80	85	82	447	0.334	5.44	0.36	13.9	0.040	7.0	10.21	5	14.6	10.6	99.3
264	165	103	267	312	377	271	266	1420	80	82	78	442	0.327	5.26	0.34	14.3	0.027	6.7	9.83	3	15.2	10.8	99.6
269	170	105	271	310	373	267	265	1425	80	80	80	447	0.336	5.08	0.34	14.6	0.034	6.3	11.50	5	15.9	9.4	99.2
274	175	99	277	310	384	269	268	1422	78	80	80	447	0.331	4.88	0.36	14.2	0.051	6.7	13.05	7	15.2	8.5	99.0
279	180	98	274	313	380	274	268	1400	81	78	78	428	0.313	4.74	0.29	14.6	0.019	6.3	8.80	2	16.0	11.9	99.7
284	185	99	282	311	380	269	268	1339	78	82	82	400	0.291	4.60	0.23	15.6	0.014	5.4	8.23	1	18.2	12.7	99.9
289	190	104	287	313	365	268	267	1299	83	81	81	385	0.281	4.54	0.18	15.8	0.012	5.1	7.49	1	18.8	13.7	99.9
294	195	102	287	313	354	270	265	1251	81	85	76	370	0.265	4.44	0.16	16.1	0.010	4.9	6.97	1	19.5	14.6	99.9
299	200	97	291	313	343	265	262	1172	85	80	80	361	0.260	4.38	0.13	16.4	0.011	4.5	7.07	1	20.7	14.4	99.9
304	205	100	293	315	322	274	261	1106	80	83	83	354	0.250	4.33	0.11	16.6	0.007	4.4	6.66	0	21.2	15.1	100.0
309	210	102	292	320	313	268	259	1068	81	81	81	348	0.244	4.26	0.12	16.6	0.011	4.3	6.40	1	21.5	15.6	99.9
314	215	105	292	312	303	264	255	1031	79	81	77	333	0.232	4.24	0.09	16.8	0.011	4.2	6.14	1	22.0	16.2	99.8
319	220	107	292	316	290	269	255	1013	84	80	80	331	0.231	4.17	0.09	16.8	0.008	4.2	6.07	0	21.9	16.3	100.0
324	225	105	290	314	293	275	256	997	78	84	80	323	0.224	4.13	0.09	17.2	0.011	3.7	6.16	1	23.8	16.1	99.9
329	230	105	296	305	281	264	250	988	77	83	79	325	0.224	4.08	0.09	17.2	0.008	3.8	6.08	-1	23.8	16.3	99.9
334	235	98	289	304	272	265	246	985	81	81	79	317	0.222	4.04	0.06	17.4	0.010	3.6	5.84	1	24.7	16.8	99.9
339	240	98	290	303	270	275	247	1015	88	77	81	322	0.217	4.01	0.05	17.7	0.016	3.3	5.64	4	26.1	17.1	99.5
344	245	96	288	301	262	266	242	992	81	79	79	316	0.213	3.97	0.04	17.7	0.014	3.3	5.71	2	26.2	16.9	99.7
349	250	94	285	300	263	259	240	967	79	83	79	309	0.207	3.92	0.09	17.7	0.016	3.2	5.65	3	26.6	17.1	99.5
354	255	98	288	292	253	264	239	953	73	81	79	297	0.202	3.90	0.05	17.8	0.018	3.1	5.80	3	27.3	16.8	99.6

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %
359	260	99	284	288	243	256	234	931	80	77	82	295	0.198	3.85	0.07	17.8	0.014	3.1	5.91	2	26.9	16.5	99.8
364	265	91	281	285	239	246	228	913	77	79	79	294	0.195	3.83	0.05	17.8	0.012	3.2	5.88	1	27.0	16.6	99.9
369	270	97	280	285	235	259	231	902	78	78	76	287	0.191	3.79	0.06	17.6	0.018	3.3	5.78	3	26.1	16.8	99.5
374	275	92	276	279	222	248	223	901	75	79	75	290	0.189	3.74	0.07	17.2	0.017	3.7	7.49	2	24.2	13.6	99.7
379	280	97	267	284	221	254	224	891	80	75	73	286	0.190	3.70	0.09	17.3	0.018	3.7	6.49	3	24.3	15.3	99.5
384	285	97	273	269	213	245	220	877	76	82	82	282	0.184	3.63	0.09	17.4	0.014	3.5	7.39	1	24.9	13.8	99.8
389	290	93	273	271	215	245	219	871	78	78	73	284	0.180	3.61	0.09	17.4	0.016	3.5	6.37	2	25.0	15.5	99.7
394	295	96	266	272	209	246	218	874	79	79	75	279	0.177	3.56	0.09	17.5	0.016	3.4	7.39	2	25.5	13.7	99.7
399	300	94	263	268	207	246	216	861	79	79	79	281	0.175	3.54	0.07	17.6	0.017	3.4	6.86	3	25.6	14.6	99.6
404	305	97	265	267	206	241	215	842	76	80	78	271	0.172	3.49	0.05	17.5	0.016	3.4	6.05	3	25.6	16.2	99.6
409	310	90	258	258	210	245	212	846	75	78	75	275	0.171	3.47	0.04	17.6	0.020	3.4	7.22	4	25.8	14.0	99.4
414	315	93	256	261	198	235	208	846	76	78	80	265	0.171	3.40	0.07	17.6	0.018	3.4	7.15	3	25.7	14.0	99.6
419	320	93	257	254	200	241	209	861	74	83	76	270	0.167	3.38	0.07	17.5	0.015	3.4	6.43	2	25.6	15.4	99.7
424	325	97	252	258	196	241	209	855	78	78	76	269	0.170	3.33	0.07	17.5	0.019	3.4	7.00	4	25.6	14.3	99.4
429	330	86	242	251	197	240	203	872	79	75	75	262	0.172	3.31	0.07	17.5	0.019	3.4	6.27	3	25.3	15.6	99.5
434	335	94	253	251	199	240	207	889	75	75	73	273	0.173	3.27	0.06	17.4	0.026	3.5	6.19	5	25.0	15.8	99.3
439	340	97	251	254	195	241	208	893	78	80	80	273	0.177	3.22	0.07	17.5	0.022	3.4	6.65	4	25.5	14.9	99.4
444	345	93	246	246	201	237	205	888	74	76	76	270	0.173	3.20	0.07	17.5	0.027	3.4	6.32	6	25.3	15.5	99.2
449	350	96	251	244	197	236	205	893	75	77	77	273	0.175	3.15	0.05	17.5	0.026	3.4	6.09	5	25.2	16.0	99.3
454	355	85	250	253	205	242	207	870	77	81	85	276	0.175	3.11	0.06	17.4	0.026	3.5	6.25	5	24.9	15.7	99.2
459	360	95	241	239	196	230	200	809	76	78	76	263	0.165	3.08	0.07	17.5	0.019	3.5	6.06	3	24.9	16.0	99.6
464	365	93	239	236	198	236	200	798	71	78	76	262	0.160	3.04	0.07	17.5	0.021	3.4	5.70	3	25.3	16.9	99.5
469	370	97	247	238	187	232	200	792	75	78	80	256	0.159	3.02	0.04	17.4	0.023	3.5	5.65	4	24.9	17.0	99.4
474	375	90	253	232	197	227	200	794	73	77	73	253	0.156	2.97	0.07	17.5	0.024	3.5	6.08	4	25.0	16.0	99.4
479	380	92	247	238	184	234	199	793	75	75	77	253	0.156	2.93	0.09	17.6	0.023	3.3	5.97	4	25.6	16.2	99.4
484	385	88	241	237	187	228	196	831	78	76	78	256	0.160	2.90	0.07	17.6	0.031	3.3	5.90	8	25.8	16.3	98.9
489	390	90	242	232	188	227	196	841	77	77	73	255	0.160	2.88	0.05	17.6	0.032	3.4	5.81	7	25.5	16.5	99.0
494	395	83	238	220	182	220	189	843	81	83	79	255	0.160	2.86	0.04	17.5	0.035	3.4	5.96	8	25.0	16.1	98.9
499	400	92	240	231	190	222	195	843	77	72	72	255	0.164	2.81	0.07	17.7	0.033	3.2	5.67	8	26.2	16.8	98.8
504	405	88	246	223	184	214	191	835	73	81	79	257	0.163	2.79	0.07	17.8	0.033	3.1	5.47	9	26.8	17.3	98.7
509	410	87	244	222	181	218	190	824	72	72	76	252	0.163	2.74	0.07	17.8	0.029	3.1	5.78	7	26.7	16.5	99.0
514	415	92	236	217	184	214	189	827	75	77	75	258	0.163	2.72	0.07	17.8	0.031	3.1	5.82	7	26.8	16.4	99.0
519	420	90	240	210	171	214	185	812	71	79	71	251	0.162	2.68	0.06	17.8	0.037	3.1	5.09	10	26.7	18.3	98.6
524	425	88	231	216	182	218	187	808	77	79	79	257	0.160	2.65	0.05	18.1	0.036	2.8	5.13	12	28.9	18.1	98.3
529	430	93	235	216	181	213	188	805	74	74	76	254	0.159	2.63	0.05	18.1	0.039	2.8	5.25	11	28.4	17.8	98.5
534	435	91	222	211	181	211	183	796	76	76	80	254	0.160	2.59	0.06	18.2	0.038	2.8	5.03	12	29.0	18.4	98.3
539	440	93	237	209	179	217	187	790	76	78	72	252	0.155	2.59	0.04	18.1	0.035	2.8	5.09	9	28.8	18.2	98.7
544	445	88	227	208	169	206	180	785	73	77	71	251	0.153	2.54	0.05	18.1	0.034	2.8	5.22	9	28.6	17.9	98.6
549	450	86	224	202	176	208	179	779	76	78	78	247	0.153	2.52	0.07	18.1	0.034	2.8	5.14	10	28.3	18.0	98.6
554	455	91	231	203	175	203	180	782	76	76	74	248	0.155	2.47	0.07	18.0	0.038	2.9	5.12	11	28.0	18.1	98.4
559	460	87	228	209	174	204	180	773	74	78	76	245	0.152	2.45	0.07	18.0	0.036	2.9	4.87	10	27.9	18.8	98.6
564	465	91	231	196	172	198	178	769	78	76	76	241	0.149	2.43	0.04	18.2	0.038	2.7	4.89	10	29.0	18.7	98.6
569	470	90	228	199	176	195	178	768	75	75	77	240	0.145	2.40	0.05	18.2	0.039	2.8	5.09	12	29.0	18.1	98.3
574	475	87	228	198	172	202	178	765	78	76	76	239	0.146	2.36	0.09	18.1	0.043	2.8	5.13	14	28.8	18.0	98.0
579	480	88	221	195	167	186	172	760	75	77	75	240	0.146	2.36	0.04	18.2	0.040	2.8	4.89	13	29.0	18.7	98.1
584	485	83	216	192	166	197	171	751	77	75	72	242	0.143	2.27	0.11	18.2	0.034	2.8	4.79	11	29.0	19.0	98.4
589	490	88	218	195	167	195	172	749	79	73	77	234	0.140	2.29	0.05	18.1	0.040	2.8	4.71	11	28.9	19.2	98.4

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %
594	495	86	223	191	167	186	171	752	73	75	77	236	0.141	2.27	0.04	18.0	0.043	2.9	5.20	12	28.0	17.8	98.3
598	499	90	219	189	161	187	169	752	75	75	75	236	0.142	2.22	0.07	18.0	0.046	3.0	5.13	13	27.6	18.0	98.1

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %

* Real time data is presented at 5 minute intervals. Average values appearing in this report are based on more frequent measurements

Notes:

Results Table = Prototypes
Filename = DefCFB20201902141
Test Stand B No changes to stove. Cat-Installed. Air wired close.Fan on low.
P0-(kg)- Started pre-burn.
P25-(3.65kg)- Stir.
P50-(2.95kg)- Stir.
P77-(2.45kg)- Stir.
P80-(2.36kg)- Set draft.Analyzers on.
P96-(2.24kg)- Leveled and packed coal bed.
99-(2.22kg)- Doors and damper closed after loading. Air wired closed,not touched.Fan on low.

CAT

Stove Name: DefCFB2020 **Test Date:** 02/22/19 **Run #:** 1

Dilution Tunnel C Factor: C Barometer Start: C End: C in. hg.

PM Train 1	Pre-Test	Post-Test	24 hr	Final
Date / Time	7:45AM	6:00AM		6:00AM
Probe ~~#1~~	.9227	.9229		.9221 g.
Filters ~~#1~~	.2322	.2352		.2353 g.
Gas Meter	581.830	683.8	O-Ring Residue =	g.

PM Train 2	Pre-Test	Post-Test	24 hr	Final
Probe				g.
Filters				g.
Gas Meter			O-Ring Residue =	g.

PM Emission Rate-

WET: .30 **g/hr**

Date: 02/25

FINAL: .29 **g/hr**

Date: 03/04

BURN RATE-

1.16 **kg/hr**

415 MMS
DT -59°
267°
208°

PRE-TEST FUEL LOAD Kindling Weight: 2.72 kg

# of 2 x 4's: 28 # of 4 x 4's: X Length ='s: 8 In.

Weight: 12.24 kg. Placed on: 1.46 kg. Coal Bed @ Record #: 0 —

27 lbs

Air Setting Moved to: first mark at 4.54 kg. (10 lbs) Coal Bed @ Record #: 0 —

400 2 lbs

NOTES: Fan (on) / off High

TEST FUEL LOAD

Stove Volume: 3.25 Cu. Ft. X 3.17 kg./Cu. Ft. = 10.363 kg.

Length: 20 In. # of 2 x 4's: X # of 4 x 4's: 4 # of Spacers: 12

Fuel Moisture

Rear ~~2~~x4 19.1 **Rear 4x4** 19.1 **Front ~~2~~x4** 19.1 **Front 4x4** 19.1

M.C. Dry = 100 / (100 / M.C. Wet – 1) M.C. Wet = 100 x M.C. Dry / (100 + M.C. Dry)

Moisture Content: 19.1 % Dry Basis

Actual Fuel Weight: 9.58 kg. (Wet)

4.25 lbs

x 0.20 = 1.916 kg. (Low End Coal Bed Target)

x 0.25 = 2.395 kg. (High End Coal Bed Target)

5.25 lbs **Initial:** DW

NOTES:

Prototypes | DefCFB2020 | 2/22/2019 | 1 | DefCFB20201902221

Results Table = 'Prototypes
Filename = DefCFB20201902221
Test Stand B Cat-installed. Air set on mark on stove. Fan on high.
P0-(kg)- Started pre-bun,

Tunnel B Factor = 0.93
Avg Tun Flow (scfm) 150.7

	Pre-Test	Post-Test	Meter 1 Factor= 0.99					Stove
Probe 1	0.9227	0.9227						
Filters 1	0.2322	0.2353						
O-Ring Residue =		0						
Gas Meter 1	581.83	683.8	Catch (mg) 3.1	Meter Temp (deg F) 96.5	Meter Volume (scf) 95.78	PM Conc (mg/scf) 0.032	PM Rate 1 (g/hr) 0.29	5G

			Meter 2 Factor= 0.944					
Probe 2	0	0						
Filters 2	0	0						
O-Ring Residue =		0						
Gas Meter 2	0	0	Catch (mg) 0	Meter Temp (deg F) 81.1	Meter Volume (scf) 0	PM Conc (mg/scf) 0	PM Rate 2 (g/hr) 0	5G

Time	11:35 AM	6:31 PM		Test Elapsed Time =	415	min
Record #	101	516		Dry Burn Rate =	1.16	kg/hr
Barometer	29.92	29.92	in Hg	Avg PM Rate =	0.29	g/hr
Lab Temp	80	73	deg F	Avg PM Factor =	0.25	g/kg
Avg Stove	267	208	deg F	EPA Avg A/F	27.9	
				Stove Delta T =	-59	deg F
				H.C. Factor =	0	g/kg as CH4
				CO Factor =	1.1	g/kg
				TCC Efficiency =	55.7	%
				Comb. Efficiency =	99.7	%
				Avg Stack T =	349.5	deg F

EPA Cat. 2

Wet Wood (kg)	Wood Moisture (dry %)	Coal Bed (kg)	Dry Wood (kg)
9.58	19.1	2.02	8.04

Avg Stack Gasses (Ambient Corrected)

Avg CO	0.0028	Vol %
Avg CO2	3.047	Vol %
Avg O2	17.914	Vol %
Avg HC	0	Vol % as CH4
Avg TCC	0.0099	Vol % as CO2

Vermont Castings Group, Bethel **EMISSIONS TEST RESULTS REPORT** Results Table: Prototypes

Stove Name: DefCFB2020 Test Date: 2/22/2019 Run #: 1 File: DefCFB2020190 Record # Start 101 Stop 516

Test Time	415	min
Wet Wood	9.58	kg
Moisture	19.1	dry %
Dry Wood	8.04	kg
Coal Bed	2.02	kg
Stove DeltaT	-59	deg F
Tunnel CD	0.93	

Avg Stack Gasses (amb Corrected)

CO 0.0028 %
CO2 3.047 %
O2 17.914 %
HC 0 % as CH4
TCC 0.0099 % as CO2

PM Trains - EPA 5G-3

	Catch mg	Vol scf	Tun Flow scfm	PM Rate 5g	Prec. %
Train 1	3.10	95.78	150.7	.29	n/a
Train 2	0	0		0	

Average Rate 5G 0.29 g/hr (5g)

Results

PM g/hr (5g)	PM g/kg (5g)	Dry Burn Rate kg/hr	EPA Cat.	EPA A/F	TCC Efficiency	CO g/kg	HC g/kg (CH4)
0.29	**0.25**	**1.16**	**2**	**27.9**	**55.7**	**1.1**	**0**

Heat Output **12,400** Btu/hr (measured efficiency)

Real Time Data*

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %
0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	0.00	0.00	0.0	0.000	0.0	0.00	0	0.0	0.0	0.0
5	5	594	272	296	147	405	343	1057	77	72	77	352	0.302	4.58	-4.58	20.3	0.020	0.6	0.62	0	90.9	92.2	100.0
10	10	519	259	279	152	403	322	1285	73	83	79	403	0.323	4.38	0.38	20.3	0.022	0.6	0.61	-182	90.7	92.2	0.0
15	15	475	252	252	174	391	309	1247	80	78	78	402	0.318	4.22	0.32	20.3	0.020	0.6	0.61	-339	90.4	91.7	0.0
20	20	453	232	243	183	384	299	1261	78	78	74	390	0.312	3.99	0.36	20.3	0.021	0.6	0.61	-395	90.8	92.2	0.0
25	25	432	226	241	198	382	296	1265	78	78	76	404	0.328	3.72	0.45	20.3	0.019	0.6	0.61	72	90.9	92.2	0.0
30	30	419	224	232	209	376	292	1332	80	76	82	406	0.323	3.51	0.46	20.3	0.020	0.6	0.61	-169	90.4	91.7	0.0
35	35	421	220	222	222	371	291	1385	74	80	78	426	0.331	3.31	0.39	20.3	0.020	0.6	0.61	790	90.9	92.2	0.0
40	40	427	212	227	227	366	292	1344	84	84	80	410	0.322	3.13	0.32	20.3	0.020	0.6	0.60	0	90.9	92.2	100.0
45	45	426	220	224	226	365	292	1272	74	76	74	397	0.298	2.99	0.28	20.3	0.020	0.6	0.61	-790	90.9	91.6	0.0
50	50	426	210	231	231	361	292	1202	79	79	81	385	0.292	2.88	0.23	20.3	0.020	0.6	0.59	0	90.9	92.2	100.0
55	55	429	212	230	225	360	291	1122	71	80	78	366	0.273	2.77	0.20	20.3	0.019	0.6	0.59	-198	90.5	91.8	0.0
60	60	427	216	229	212	351	287	1039	79	79	75	362	0.078	2.79	0.07	20.3	0.019	0.6	0.58	0	90.9	92.2	100.0
65	65	410	219	228	210	349	283	1263	82	73	80	412	0.307	2.47	0.30	13.8	0.310	7.0	16.78	50	14.1	6.4	93.2
70	70	395	217	223	219	345	280	1273	82	76	76	401	0.294	2.34	0.29	14.6	0.060	6.3	15.29	10	16.0	7.3	98.6
75	75	395	211	224	217	345	278	1201	84	80	78	389	0.279	2.24	0.21	15.5	0.019	5.5	13.43	2	18.0	8.3	99.6
80	80	400	213	224	226	346	282	1237	81	79	79	387	0.286	2.11	0.20	16.1	0.047	4.8	14.07	10	19.7	7.5	98.6
85	85	404	218	226	218	341	281	1135	74	78	76	380	0.270	1.97	0.25	15.9	0.029	5.1	12.26	5	19.1	8.9	99.3
90	90	392	214	222	218	342	277	1068	79	77	79	359	0.246	2.11	-0.02	17.3	0.009	3.7	8.86	2	24.5	11.9	99.7
95	95	376	218	227	216	335	274	1010	77	79	75	339	0.233	2.09	0.09	17.8	0.010	3.2	7.75	2	26.8	13.3	99.7
100	100	373	211	224	202	341	270	952	82	82	82	345	0.230	2.02	0.11	17.8	0.007	3.1	6.96	0	27.1	14.4	100.0
101	0	378	211	222	198	330	268	948	80	80	80	328	0.210	2.02	0.09	17.8	0.007	3.1	6.96	0	27.1	14.4	100.0
106	5	336	211	213	198	325	257	1170	82	80	78	354	0.261	11.47	-9.41	16.9	0.015	4.0	13.36	4	22.6	8.2	99.5
111	10	306	192	200	200	326	245	1209	78	80	78	376	0.276	11.34	0.25	16.6	0.017	4.3	13.23	2	21.6	8.3	99.7
116	15	286	183	193	206	317	237	1255	80	76	82	395	0.291	11.16	0.29	16.5	0.027	4.4	14.18	4	21.1	7.8	99.4

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %
121	20	274	188	185	222	313	236	1285	76	81	81	400	0.294	11.00	0.29	16.5	0.016	4.4	14.02	2	21.3	7.9	99.7
126	25	273	173	176	229	307	232	1317	79	84	82	401	0.303	10.79	0.34	16.3	0.017	4.6	13.95	3	20.5	8.0	99.6
131	30	264	182	176	238	303	233	1363	76	76	80	429	0.320	10.59	0.34	16.2	0.011	4.8	13.87	1	20.1	8.0	99.8
136	35	272	173	175	255	309	237	1423	79	79	83	446	0.336	10.34	0.39	15.9	0.006	5.0	14.15	0	19.3	7.9	100.0
141	40	282	178	174	263	304	240	1395	76	80	78	441	0.335	10.14	0.40	15.9	0.009	5.0	14.26	1	19.3	7.8	99.9
146	45	274	177	177	261	303	239	1447	81	75	85	452	0.342	9.86	0.46	15.9	0.010	5.0	15.32	2	19.3	7.3	99.8
151	50	287	174	174	269	291	239	1446	80	78	80	456	0.345	9.64	0.43	16.4	0.005	4.6	14.74	-1	20.7	7.6	99.9
156	55	293	172	179	269	306	244	1451	78	80	76	458	0.347	9.41	0.43	16.2	0.011	4.7	14.26	1	20.2	7.8	99.9
161	60	303	186	184	281	303	251	1475	81	81	79	461	0.350	9.14	0.45	16.1	0.011	4.8	15.14	2	20.0	7.4	99.7
166	65	305	182	184	277	307	251	1441	84	82	82	453	0.345	8.89	0.45	16.5	0.005	4.5	15.03	-1	21.1	7.4	99.9
171	70	311	188	182	277	316	255	1436	81	81	77	455	0.343	8.62	0.47	16.6	0.011	4.4	14.61	2	21.4	7.6	99.7
176	75	324	186	190	277	303	256	1494	86	83	86	463	0.351	8.37	0.47	16.3	0.006	4.6	15.64	-1	20.5	7.2	99.9
181	80	330	190	179	287	304	258	1521	81	76	81	467	0.357	8.10	0.49	16.3	0.008	4.6	15.87	1	20.4	7.1	99.9
186	85	338	191	188	290	305	262	1524	84	84	84	468	0.357	7.80	0.52	16.6	0.011	4.4	15.30	1	21.4	7.3	99.9
191	90	346	192	195	290	307	266	1518	83	83	81	472	0.355	7.55	0.48	16.9	0.007	4.1	15.05	0	22.8	7.4	100.0
196	95	353	199	193	288	307	268	1516	84	82	82	468	0.354	7.28	0.48	17.2	0.011	3.7	14.90	1	24.3	7.5	99.8
201	100	366	193	198	293	310	272	1506	80	91	84	471	0.352	7.03	0.45	17.0	0.009	3.9	14.46	2	23.2	7.7	99.8
206	105	371	204	208	292	305	276	1446	77	82	88	455	0.341	6.80	0.43	17.2	0.008	3.7	13.27	0	24.2	8.3	100.0
211	110	371	202	211	288	304	275	1425	84	84	80	451	0.337	6.60	0.38	17.3	0.006	3.6	12.91	2	24.6	8.5	99.8
216	115	384	197	212	284	310	277	1422	82	82	84	444	0.332	6.42	0.36	17.5	0.009	3.5	12.79	1	25.3	8.6	99.8
221	120	394	201	218	283	298	279	1401	79	81	81	437	0.327	6.21	0.37	17.5	0.000	3.5	12.86	-2	25.4	8.6	99.7
226	125	393	200	217	265	304	276	1358	76	85	78	436	0.325	6.01	0.34	17.7	0.003	3.3	11.79	1	26.5	9.3	99.9
231	130	403	205	216	264	301	278	1354	71	79	73	427	0.336	5.76	0.41	17.8	0.003	3.1	12.02	2	27.3	9.1	99.7
236	135	401	204	215	251	295	273	1393	76	80	76	440	0.344	5.51	0.45	17.8	0.009	3.1	12.89	0	27.4	8.5	99.9
241	140	407	206	212	253	288	273	1433	71	75	71	448	0.348	5.24	0.50	17.5	0.008	3.4	13.26	-1	25.5	8.3	99.8
246	145	415	209	219	258	291	278	1444	69	72	74	454	0.355	4.94	0.50	17.5	0.016	3.5	13.11	1	25.4	8.4	99.8
251	150	417	211	213	261	280	276	1406	74	78	72	445	0.350	4.72	0.45	17.6	0.017	3.3	12.18	0	25.9	9.0	99.9
256	155	418	210	225	260	275	277	1352	75	81	73	435	0.336	4.47	0.43	17.8	0.009	3.2	11.17	-1	26.9	9.7	99.8
261	160	421	211	226	254	278	278	1313	71	76	69	414	0.320	4.26	0.37	17.8	0.014	3.1	11.30	3	27.3	9.6	99.6
266	165	435	212	221	244	281	279	1268	71	81	71	401	0.306	4.08	0.34	17.8	0.014	3.1	10.38	2	27.0	10.3	99.7
271	170	441	216	227	240	287	282	1255	77	81	74	398	0.306	3.95	0.27	17.4	0.012	3.6	10.78	1	24.7	10.0	99.9
276	175	440	211	236	234	280	280	1232	76	78	76	388	0.284	3.83	0.23	17.6	0.006	3.3	10.42	1	26.3	10.3	99.9
281	180	433	221	231	229	290	281	1179	77	77	77	379	0.273	3.72	0.20	18.0	0.005	2.9	9.93	-2	28.8	10.8	99.8
286	185	430	224	231	235	285	281	1145	78	78	80	372	0.264	3.67	0.14	18.3	0.011	2.6	8.11	2	31.4	12.9	99.7
291	190	428	222	235	216	292	279	1080	77	83	81	357	0.253	3.61	0.11	18.6	0.008	2.4	7.46	1	33.2	13.8	99.8
296	195	431	219	240	208	295	279	1017	75	77	77	345	0.239	3.56	0.09	18.5	0.000	2.4	7.16	2	32.6	14.2	99.8
301	200	418	216	237	201	292	273	967	81	83	81	331	0.228	3.54	0.07	18.5	0.011	2.4	7.46	0	32.6	13.8	100.0
306	205	411	211	233	188	293	267	931	76	81	78	322	0.219	3.49	0.09	18.5	0.008	2.5	7.24	2	32.2	14.1	99.7
311	210	404	211	235	188	291	266	907	76	79	79	317	0.213	3.45	0.06	18.4	0.001	2.5	7.22	-2	31.5	14.2	99.7
316	215	394	206	234	178	301	263	895	80	80	77	308	0.208	3.42	0.07	18.5	0.010	2.4	7.21	4	32.6	14.1	99.4
321	220	394	212	236	173	294	262	874	79	73	77	303	0.201	3.38	0.04	18.7	0.006	2.3	7.30	3	33.7	14.0	99.6
326	225	388	206	232	169	288	256	862	75	79	79	303	0.196	3.33	0.07	18.6	0.007	2.3	7.30	3	33.0	13.9	99.6
331	230	383	205	224	168	298	256	853	77	79	81	300	0.195	3.31	0.05	18.5	0.009	2.4	7.24	-1	32.1	14.0	99.9
336	235	381	201	229	162	301	255	849	75	81	77	292	0.191	3.29	0.04	18.6	0.006	2.4	7.39	-2	32.8	13.8	99.7
341	240	376	201	222	158	298	251	830	75	77	75	292	0.187	3.24	0.07	18.5	0.009	2.5	7.48	3	31.8	13.6	99.6
346	245	374	200	224	155	289	248	821	76	76	80	287	0.185	3.20	0.09	18.5	0.009	2.5	7.45	-1	31.5	13.7	99.9
351	250	375	193	227	156	294	249	827	75	79	77	286	0.185	3.13	0.09	18.4	0.000	2.6	7.52	-5	31.0	13.6	99.3

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %
356	255	368	192	224	158	289	246	826	75	77	75	285	0.184	3.13	0.04	18.4	0.003	2.6	7.49	-4	30.9	13.6	99.4
361	260	379	190	216	147	290	244	839	77	77	75	285	0.184	3.08	0.05	18.5	0.012	2.5	7.49	1	31.6	13.6	99.9
366	265	372	192	214	156	285	244	845	75	79	77	283	0.186	3.06	0.07	18.6	0.007	2.4	7.41	-3	32.1	13.7	99.6
371	270	367	193	215	153	291	244	848	78	78	80	284	0.186	3.02	0.06	18.5	-0.00	2.5	7.33	-5	31.7	13.8	99.3
376	275	368	197	214	163	286	246	852	73	79	75	286	0.186	2.99	0.05	18.5	0.005	2.4	7.51	0	31.9	13.5	100.0
381	280	368	193	214	156	286	243	854	77	79	79	286	0.186	2.95	0.07	18.5	0.013	2.4	7.39	1	32.0	13.7	99.9
386	285	368	191	212	148	284	240	858	79	75	77	290	0.185	2.93	0.04	18.5	0.013	2.4	7.42	2	31.7	13.6	99.7
391	290	368	180	206	148	282	237	856	75	80	80	288	0.186	2.88	0.07	18.7	0.016	2.2	7.43	5	34.0	13.6	99.2
396	295	364	189	202	156	290	240	860	73	77	75	286	0.187	2.83	0.07	18.7	0.012	2.2	7.75	1	34.0	13.1	99.9
401	300	355	184	199	150	275	233	856	80	80	80	284	0.186	2.81	0.05	18.8	0.011	2.1	8.30	4	35.1	12.4	99.4
406	305	359	187	205	153	274	235	844	76	76	74	280	0.185	2.79	0.07	18.8	0.015	2.2	8.28	4	34.5	12.4	99.4
411	310	352	190	196	151	261	230	826	74	76	76	280	0.182	2.72	0.09	18.7	0.012	2.2	8.35	2	33.7	12.3	99.8
416	315	350	189	194	149	272	231	826	80	76	76	282	0.181	2.68	0.09	18.7	0.011	2.2	8.20	4	33.7	12.5	99.4
421	320	356	183	192	140	265	227	820	76	79	76	276	0.181	2.65	0.07	18.7	0.007	2.2	8.10	2	33.8	12.6	99.7
426	325	345	194	192	149	265	229	824	80	78	78	274	0.180	2.63	0.07	18.7	0.011	2.2	7.85	4	34.0	12.9	99.4
431	330	346	183	185	153	263	226	828	74	78	78	274	0.181	2.59	0.06	18.7	0.011	2.2	7.99	3	33.5	12.7	99.5
436	335	345	181	185	144	267	225	826	76	76	72	278	0.183	2.56	0.07	18.7	0.012	2.2	7.89	-1	33.9	12.9	99.9
441	340	338	184	184	144	266	223	827	77	75	77	275	0.182	2.52	0.07	18.7	0.006	2.2	7.68	-1	33.9	13.2	99.8
446	345	337	192	179	149	263	224	828	76	79	74	274	0.185	2.47	0.07	18.9	0.014	2.1	7.50	6	35.3	13.4	99.2
451	350	340	178	180	146	266	222	827	77	75	79	275	0.181	2.47	0.05	18.9	0.002	2.0	7.41	-4	35.9	13.6	99.4
456	355	334	182	186	141	260	221	823	73	77	77	275	0.182	2.43	0.06	18.9	0.009	2.1	7.18	-3	34.9	13.9	99.5
461	360	334	176	176	141	258	217	785	80	80	77	269	0.174	2.38	0.07	18.8	0.006	2.1	7.18	1	34.7	13.9	99.9
466	365	334	179	168	140	256	215	771	78	78	78	267	0.173	2.36	0.07	18.7	0.004	2.2	6.95	-2	33.9	14.3	99.7
471	370	325	184	174	139	258	216	773	75	75	77	260	0.173	2.31	0.07	18.8	0.008	2.2	6.90	-4	34.2	14.4	99.5
476	375	321	182	176	137	260	215	775	75	80	75	262	0.171	2.29	0.05	18.8	0.007	2.1	6.66	-2	34.5	14.8	99.7
481	380	329	182	175	130	253	214	774	77	75	75	264	0.170	2.24	0.07	18.8	0.015	2.2	6.52	6	34.4	15.1	99.1
486	385	327	171	175	136	259	214	755	75	79	77	257	0.165	2.20	0.07	19.0	0.019	1.9	6.34	8	36.9	15.4	98.8
491	390	322	180	169	137	251	212	730	75	77	75	260	0.159	2.18	0.06	18.7	0.005	2.2	6.62	-4	34.1	14.9	99.4
496	395	319	175	162	134	248	207	730	76	76	76	254	0.159	2.13	0.07	18.8	0.013	2.2	6.25	5	33.9	15.5	99.2
501	400	327	182	169	141	251	214	724	75	77	79	255	0.157	2.11	0.07	18.9	0.011	2.1	5.97	4	34.9	16.1	99.4
506	405	323	176	161	133	254	210	714	78	76	72	252	0.158	2.09	0.04	18.9	0.010	2.0	5.74	1	35.4	16.6	99.8
511	410	317	178	168	129	252	209	702	78	76	76	243	0.155	2.04	0.07	19.0	0.003	2.0	5.61	-1	36.3	16.9	99.9
516	415	317	166	174	129	252	208	700	74	74	72	248	0.156	2.02	0.07	19.0	0.014	1.9	5.32	0	36.2	17.6	100.0

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %

* Real time data is presented at 5 minute intervals. Average values appearing in this report are based on more frequent measurements

Notes:

Results Table = Prototypes
Filename = DefCFB20201902221
Test Stand B Cat-Installed. Air set on mark on stove. Fan on high.
P0-(kg)- Started pre-bun,
P22-(3.81kg)- Stir.
P60-(2.63kg)- Stir
P61-(2.61kg)- set draft.Analyzers on.
P77-(2.22kg)- Stir.
P83-(2.04kg)- Stir.
P98-(2.06kg)- Leveled and packed coal bed.
101-(2.02kg)- Doors and damper closed after loading. Air set on mark on stove,Fan on high.

CAT

Stove Name: DfCFB2020 **Test Date:** 02/26/19 **Run #:** 1

Dilution Tunnel U Factor: U Barometer Start: U End: U in. hg.

PM Train 1	Pre-Test	Post-Test	24 hr	Final
Date / Time	7:15 AM	6:00 AM		6:00 AM
Probe #L	.1143	.1143		.1143 g.
Filters #L	.2358	.2391		.2391 g.
Gas Meter	683.850	785.7	O-Ring Residue =	g.

PM Train 2	Pre-Test	Post-Test	24 hr	Final
Probe				g.
Filters				g.
Gas Meter			O-Ring Residue =	g.

PM Emission Rate-

WET: .31 **g/hr**

Date: 2/27

FINAL: .31 **g/hr**

Date: 03/04

BURN RATE-

1.24 **kg/hr**

427 mins

DT - 84° 297

213

PRE-TEST FUEL LOAD Kindling Weight: 2.72 kg

# of 2 x 4's: 28 # of 4 x 4's: X Length =s: 8 In.

29.5165 Weight: 1339 kg. Placed on: 1.46 kg. Coal Bed @ Record #: U

2nd mark 12165

Air Setting Moved to: up at 5.44 kg. Coal Bed @ Record #: O

NOTES: Fan (on) off Low

TEST FUEL LOAD

Stove Volume: 3.25 Cu. Ft. X 3.17 kg./Cu. Ft. = 10.303 kg.

Length: 20 In. # of 2 x 4's: X # of 4 x 4's: 4 # of Spacers: 12

Fuel Moisture

Rear 2x4 22.9 **Rear 4x4** 19.2 **Front 2x4** 19.1 **Front 4x4** 19.2

M.C. Dry = 100 / (100 / M.C. Wet – 1)

M.C. Wet = 100 x M.C. Dry / (100 + M.C. Dry)

Moisture Content: 20.1 % Dry Basis

Actual Fuel Weight: 10.62 kg. (Wet)

4.70165

x 0.20 = 2.124 kg. (Low End Coal Bed Target)

x 0.25 = 2.655 kg. (High End Coal Bed Target)

NOTES: 5.85 **Initial :** D.W.

Prototypes | DefCFB2020 | 2/26/2019 | 1 | DefCFB20201902261

Results Table ='Prototypes
Filename = DefCFB20201902261
Test Stand B Cat-Installed. Air lever on second mark up from closed.Fan on high.
P0-(kg)- Started 1hr pre-burn.

Tunnel B Factor = 0.93
Avg Tun Flow (scfm) 148.8

	Pre-Test	Post-Test		Catch (mg)	Meter Temp (deg F)	Meter Volume (scf)	PM Conc (mg/scf)	PM Rate 1 (g/hr)	
Probe 1	0.1143	0.1143	Meter 1 Factor= 0.99						Stove
Filters 1	0.2358	0.2391							
O-Ring Residue =		0							
Gas Meter 1	683.85	785.7		3.3	93	96.27	0.034	0.31	5G
Probe 2	0	0	Meter 2 Factor= 0.944						
Filters 2	0	0							
O-Ring Residue =		0							
Gas Meter 2	0	0		0	78.5	0	0	0	5G

Time	10:37 AM	5:45 PM		Test Elapsed Time =	427	min
Record #	101	528		Dry Burn Rate =	1.24	kg/hr
Barometer	29.92	29.92	in Hg	Avg PM Rate =	0.31	g/hr
Lab Temp	76	72	deg F	Avg PM Factor =	0.25	g/kg
Avg Stove	297	213	deg F	EPA Avg A/F	42.3	
				Stove Delta T =	-84	deg F
				H.C. Factor =	0	g/kg as CH4
				CO Factor =	1	g/kg
				TCC Efficiency =	16.6	%
				Comb. Efficiency =	99.4	%
				Avg Stack T =	378.9	deg F

EPA Cat. 2

Wet Wood (kg)	Wood Moisture (dry %)	Coal Bed (kg)	Dry Wood (kg)
10.62	20.1	2.2	8.84

Avg Stack Gasses (Ambient Corrected)

Avg CO	0.0013	Vol %
Avg CO2	1.555	Vol %
Avg O2	19.448	Vol %
Avg HC	0	Vol % as CH4
Avg TCC	0.0107	Vol % as CO2

Vermont Castings Group, Bethel **EMISSIONS TEST RESULTS REPORT** Results Table: Prototypes

Stove Name: DefCFB2020 Test Date: 2/26/2019 Run #: 1 File: DefCFB2020190 Record # Start 101 Stop 528

Test Time	427	min
Wet Wood	10.62	kg
Moisture	20.1	dry %
Dry Wood	8.84	kg
Coal Bed	2.2	kg
Stove DeltaT	-84	deg F
Tunnel CD	0.93	

Avg Stack Gasses (amb Corrected)

CO 0.0013 %
CO2 1.555 %
O2 19.448 %
HC 0 % as CH4
TCC 0.0107 % as CO2

PM Trains - EPA 5G-3

	Catch mg	Vol scf	Tun Flow scfm	PM Rate 5g	Prec. %
Train 1	3.30	96.27	148.8	.31	n/a
Train 2	0	0		0	

Average Rate 5G 0.31 g/hr (5g)

Results

PM g/hr (5g)	PM g/kg (5g)	Dry Burn Rate kg/hr	EPA Cat.	EPA A/F	TCC Efficiency	CO g/kg	HC g/kg (CH4)
0.31	**0.25**	**1.24**	**2**	**42.3**	**16.6**	**1.0**	**0**

Heat Output **3,900** Btu/hr (measured efficiency)

Real Time Data*

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %
0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	0.00	0.00	0.0	0.000	0.0	0.00	0	0.0	0.0	0.0
5	5	656	311	311	160	372	362	1177	73	77	75	394	0.340	5.19	-5.19	21.1	0.011	-0.1	-0.17	0	91.4	92.2	100.0
10	10	564	289	292	179	365	338	1307	74	72	74	420	0.354	4.99	0.41	21.1	0.011	-0.2	-0.14	0	91.2	91.3	100.0
15	15	512	275	273	197	362	324	1323	73	78	75	442	0.358	4.78	0.37	21.1	0.011	-0.2	-0.14	0	91.3	91.3	100.0
20	20	482	258	252	213	360	313	1340	74	74	76	434	0.351	4.58	0.39	21.1	0.011	-0.2	-0.15	0	91.4	92.2	0.0
25	25	460	247	245	217	360	306	1288	74	76	74	421	0.331	4.40	0.34	21.1	0.013	-0.2	-0.15	0	91.1	92.0	0.0
30	30	454	244	239	226	363	305	1160	78	76	78	404	0.311	4.29	0.25	21.1	0.013	-0.2	-0.15	0	91.1	92.0	0.0
35	35	415	226	231	224	359	291	1358	76	78	78	448	0.352	4.04	0.34	21.1	0.013	-0.1	-0.15	0	91.0	92.2	100.0
40	40	408	222	230	237	352	290	1376	78	72	74	454	0.350	3.88	1.70	21.1	0.011	-0.2	-0.14	0	91.2	91.3	0.0
45	45	400	207	222	246	350	285	1390	77	79	75	465	0.344	3.70	0.31	21.1	0.011	-0.1	-0.14	0	90.6	91.3	0.0
50	50	407	209	222	252	359	290	1383	74	72	74	463	0.356	3.51	0.34	21.1	0.013	-0.2	-0.14	0	91.1	91.3	0.0
55	55	423	212	229	260	360	297	1367	77	75	75	457	0.349	3.33	0.32	21.1	0.012	-0.2	-0.16	0	91.2	92.0	0.0
60	60	444	212	229	255	359	300	1314	77	77	77	444	0.329	3.17	0.30	21.1	0.013	-0.2	-0.15	0	91.1	92.0	0.0
65	65	443	206	232	247	354	297	1387	78	76	78	456	0.368	2.95	0.36	21.1	0.012	-0.2	-0.16	0	91.4	92.2	100.0
70	70	458	215	239	247	362	304	1382	76	78	78	454	0.335	2.79	0.36	21.1	0.012	-0.1	-0.15	0	89.8	92.0	100.0
75	75	467	226	250	257	356	311	1345	78	78	80	437	0.333	2.63	0.30	21.1	0.012	-0.1	-0.15	0	91.1	92.1	0.0
80	80	449	226	243	250	358	305	1290	76	78	78	423	0.291	2.49	0.25	15.2	0.087	5.7	9.34	15	17.0	11.1	97.9
85	85	456	220	246	248	359	306	1226	83	76	76	402	0.294	2.40	0.21	16.2	0.031	4.7	9.07	5	20.0	11.6	99.3
90	90	443	223	247	230	358	300	1120	76	76	73	380	0.274	2.36	0.11	17.2	0.021	3.7	7.95	2	23.9	12.9	99.7
95	95	434	215	241	224	371	297	1036	78	80	72	365	0.259	2.29	0.09	17.4	0.016	3.5	7.73	1	24.8	13.2	99.9
100	100	439	224	241	203	369	295	997	78	78	76	337	0.166	8.34	-6.00	17.5	0.016	3.4	7.90	1	25.4	12.9	99.8
101	0	439	225	244	205	366	296	969	79	77	79	340	0.231	2.18	0.13	17.5	0.016	3.4	7.90	1	25.4	12.9	99.8
106	5	378	215	237	198	356	277	1185	76	76	78	376	0.291	12.70	-10.41	17.7	0.017	3.2	7.25	2	26.4	13.5	99.8
111	10	343	203	216	213	346	264	1259	78	74	76	393	0.307	12.54	0.23	17.5	0.019	3.4	7.86	2	25.5	12.5	99.6
116	15	307	199	208	219	338	254	1283	81	79	79	414	0.313	12.38	0.32	17.6	0.022	3.3	7.69	2	25.7	12.7	99.7

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %
121	20	303	188	206	223	327	249	1321	79	81	77	431	0.331	12.18	0.34	17.5	0.015	3.5	8.00	1	25.2	12.2	99.8
126	25	296	184	195	242	320	247	1352	75	79	77	448	0.340	11.95	0.41	17.6	0.021	3.3	7.82	1	26.0	12.6	99.9
131	30	290	171	188	246	316	242	1371	81	79	79	467	0.347	11.75	0.36	17.6	0.018	3.3	7.96	4	25.8	12.4	99.5
136	35	296	177	190	255	311	246	1400	74	79	77	474	0.353	11.50	0.43	17.5	0.015	3.4	8.17	1	25.4	12.3	99.8
141	40	299	185	195	262	308	250	1391	80	78	82	473	0.357	11.29	0.41	17.5	0.009	3.5	7.98	-3	25.1	12.7	99.6
146	45	297	178	189	269	313	249	1429	80	82	84	480	0.366	11.07	0.40	17.6	0.017	3.3	8.60	2	25.9	11.5	99.7
151	50	303	173	188	277	307	249	1415	77	77	77	485	0.362	10.82	0.40	17.7	0.017	3.2	8.99	0	26.4	11.3	99.9
156	55	308	178	193	271	306	251	1463	80	80	78	481	0.370	10.54	0.46	17.8	0.018	3.2	9.27	2	26.7	10.8	99.8
161	60	317	180	193	282	304	255	1486	73	76	78	492	0.375	10.29	0.46	17.7	0.019	3.2	9.45	1	26.5	10.6	99.9
166	65	312	189	198	284	310	259	1508	78	84	82	493	0.377	10.00	0.50	17.8	0.011	3.2	10.07	1	26.7	9.9	99.8
171	70	327	182	204	290	297	260	1522	77	77	77	496	0.379	9.75	0.50	17.8	0.011	3.2	10.67	-3	26.7	9.3	99.6
176	75	337	185	201	294	309	265	1545	79	83	81	500	0.385	9.46	0.49	17.8	0.019	3.1	11.37	4	26.7	8.6	99.5
181	80	347	195	206	290	308	269	1540	77	80	77	505	0.384	9.16	0.55	17.7	0.013	3.2	11.92	-2	26.4	8.3	99.7
186	85	357	196	207	296	304	272	1547	81	81	79	506	0.387	8.89	0.50	17.9	0.017	3.0	12.67	4	27.5	7.8	99.5
191	90	360	196	206	302	310	275	1555	80	80	76	512	0.391	8.57	0.55	18.6	0.022	2.3	12.55	1	32.4	7.8	99.9
196	95	367	202	215	304	308	279	1536	76	78	78	518	0.394	8.25	0.57	18.7	0.023	2.2	13.01	2	33.9	7.4	99.8
201	100	383	201	216	309	309	283	1519	83	83	81	517	0.394	7.94	0.59	19.0	0.017	1.9	13.16	-2	36.3	7.4	99.7
206	105	377	210	223	312	320	288	1518	81	79	84	511	0.386	7.64	0.55	19.1	0.023	1.8	13.12	1	37.7	7.4	99.8
211	110	377	210	223	310	312	286	1522	82	84	79	505	0.381	7.37	0.48	19.2	0.012	1.7	13.03	-4	38.8	7.5	99.4
216	115	378	213	224	304	324	289	1506	76	81	78	484	0.368	7.10	0.45	19.3	0.018	1.6	12.74	8	40.1	8.0	98.9
221	120	379	217	232	301	321	290	1501	82	82	80	481	0.363	6.87	0.45	19.3	0.018	1.6	12.44	6	40.4	8.1	99.2
226	125	386	219	241	293	325	293	1467	80	80	80	479	0.383	6.64	0.43	19.5	0.018	1.5	12.41	7	42.1	8.2	99.0
231	130	392	216	249	296	325	296	1445	79	81	79	468	0.354	6.42	0.41	19.4	0.017	1.6	12.51	-1	40.8	8.3	99.9
236	135	394	223	253	288	321	296	1450	82	82	79	468	0.353	6.21	0.39	19.6	0.006	1.3	12.41	-1	44.2	8.3	99.9
241	140	401	221	259	279	325	297	1488	81	83	79	472	0.357	5.99	0.38	19.5	0.016	1.4	12.70	0	42.3	8.0	100.0
246	145	399	212	269	286	323	298	1478	80	82	80	473	0.353	5.74	0.43	19.8	0.007	1.2	13.03	-4	46.8	7.8	99.5
251	150	401	227	266	286	334	303	1463	80	82	82	468	0.348	5.53	0.41	19.8	0.006	1.2	12.37	-5	47.2	8.1	99.3
256	155	411	222	265	278	335	302	1406	78	81	83	445	0.337	5.35	0.36	19.9	0.019	1.1	12.22	3	49.0	8.5	99.5
261	160	421	225	273	284	334	307	1325	77	77	77	425	0.313	5.22	0.27	20.0	0.001	0.9	11.10	-1	52.1	9.5	99.8
266	165	415	231	280	265	326	303	1274	81	83	83	415	0.306	5.08	0.25	19.9	0.012	1.1	10.48	10	49.1	10.1	98.5
271	170	419	226	282	258	326	302	1245	80	82	80	408	0.300	4.94	0.25	19.8	0.011	1.1	10.42	-4	48.2	10.1	99.4
276	175	421	224	289	252	328	303	1232	83	78	80	404	0.295	4.85	0.21	20.0	0.013	0.9	10.31	4	51.8	10.2	99.5
281	180	426	222	285	244	330	301	1199	81	83	78	395	0.286	4.74	0.20	20.2	0.004	0.8	9.40	0	55.6	10.9	100.0
286	185	426	224	284	232	326	298	1143	80	80	78	384	0.271	4.65	0.18	20.1	0.004	0.8	8.74	-1	54.4	11.6	99.8
291	190	430	222	280	224	326	296	1102	78	80	78	365	0.262	4.58	0.14	20.2	0.003	0.7	8.52	-11	55.7	11.9	98.4
296	195	426	222	283	220	322	295	1072	79	79	81	361	0.257	4.54	0.11	20.2	0.010	0.8	8.34	-7	55.7	12.1	99.0
301	200	428	222	278	215	319	293	1164	76	76	78	369	0.260	4.47	0.11	20.2	0.010	0.7	8.32	-1	55.5	11.9	99.8
306	205	410	215	278	209	317	286	1176	78	74	78	375	0.263	4.38	0.13	20.1	0.015	0.8	8.62	-1	53.7	11.4	99.8
311	210	410	214	271	206	310	282	1169	82	79	79	370	0.264	4.31	0.11	20.1	0.006	0.8	8.46	-12	54.3	11.6	98.3
316	215	405	214	268	201	307	279	1127	81	81	77	366	0.260	4.24	0.14	20.1	0.004	0.8	8.22	-14	53.9	11.9	98.0
321	220	406	215	267	200	310	280	1106	78	78	78	356	0.251	4.20	0.11	20.3	0.003	0.7	7.71	0	57.8	12.6	100.0
326	225	399	211	267	198	308	277	1028	78	80	78	345	0.241	4.15	0.09	20.2	0.013	0.7	7.77	7	56.2	12.6	99.0
331	230	396	213	261	196	302	274	967	76	79	79	335	0.234	4.10	0.10	20.3	0.008	0.7	7.31	-10	57.1	13.4	98.5
336	235	400	205	248	183	298	267	938	78	76	76	328	0.226	4.04	0.09	20.2	0.012	0.8	7.36	10	56.2	13.5	98.5
341	240	396	207	250	181	293	265	911	79	72	79	317	0.222	3.97	0.11	20.2	0.011	0.8	7.30	-4	55.7	13.6	99.4
346	245	393	207	245	170	293	262	898	80	78	78	315	0.215	3.92	0.12	20.1	0.013	0.8	7.15	7	54.9	13.8	99.0
351	250	394	206	247	171	286	261	887	75	77	73	310	0.213	3.88	0.09	20.2	0.008	0.7	7.04	-2	56.8	13.9	99.8

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %
356	255	392	206	234	163	286	256	883	73	75	75	310	0.212	3.81	0.09	20.1	0.009	0.8	6.84	-8	54.5	14.2	98.8
361	260	392	206	238	165	288	258	879	75	79	75	314	0.213	3.76	0.09	20.2	0.007	0.7	6.91	-12	56.6	14.1	98.3
366	265	385	212	229	156	279	252	880	73	77	73	311	0.210	3.72	0.09	20.2	0.011	0.7	7.03	-3	57.8	13.9	99.5
371	270	387	205	225	158	279	251	878	73	79	75	309	0.211	3.65	0.11	20.3	0.009	0.7	6.95	-11	58.2	14.0	98.4
376	275	383	205	220	162	276	249	870	74	79	74	305	0.208	3.61	0.11	20.2	0.016	0.7	7.24	2	57.4	13.5	99.8
381	280	382	205	217	159	278	248	863	78	76	74	308	0.208	3.56	0.09	20.2	0.008	0.7	7.29	-4	56.5	13.5	99.4
386	285	378	203	213	153	280	246	861	74	78	76	304	0.203	3.47	0.11	20.2	0.009	0.8	7.21	-5	55.3	13.6	99.2
391	290	379	205	214	156	275	246	860	75	79	73	298	0.205	3.45	0.09	20.1	0.010	0.8	7.06	3	55.0	13.8	99.6
396	295	375	202	213	152	269	242	864	73	78	78	301	0.202	3.40	0.09	20.1	0.010	0.8	6.95	3	55.2	14.0	99.6
401	300	371	197	206	156	273	241	858	71	77	80	297	0.204	3.36	0.09	20.2	0.012	0.8	7.06	1	55.6	13.8	99.8
406	305	373	203	210	154	268	242	858	73	75	73	299	0.202	3.31	0.07	20.2	0.011	0.8	6.87	0	55.7	14.1	100.0
411	310	366	200	206	148	273	239	850	75	78	73	301	0.200	3.24	0.12	20.2	0.012	0.8	6.78	1	55.6	14.3	99.8
416	315	364	201	199	148	273	237	847	73	79	73	299	0.196	3.22	0.07	20.2	0.012	0.8	6.60	0	55.9	14.6	100.0
421	320	360	202	206	157	269	239	848	76	78	78	291	0.200	3.17	0.07	20.2	0.012	0.7	6.49	-1	56.4	14.7	99.8
426	325	360	197	202	148	271	236	854	73	78	78	293	0.201	3.11	0.09	20.1	0.009	0.8	6.42	0	54.0	14.8	100.0
431	330	362	202	202	148	267	236	844	75	80	75	299	0.200	3.06	0.09	20.0	0.011	0.9	6.34	0	53.0	15.0	100.0
436	335	348	201	192	149	268	232	832	75	77	75	292	0.200	3.04	0.07	20.0	0.012	0.9	6.35	-1	52.3	15.0	99.8
441	340	347	195	197	146	271	231	833	75	77	75	292	0.196	2.99	0.09	20.0	0.009	0.9	6.25	-3	53.0	15.2	99.6
446	345	351	191	189	143	273	229	843	77	77	77	292	0.198	2.95	0.07	20.0	0.016	0.9	6.19	6	53.3	15.3	99.1
451	350	349	193	196	146	260	229	838	74	76	74	289	0.198	2.90	0.07	20.0	0.015	0.9	6.07	0	52.9	15.5	100.0
456	355	345	187	189	146	256	225	850	72	76	72	293	0.201	2.88	0.07	20.0	0.011	0.9	6.13	0	52.8	15.3	100.0
461	360	343	185	185	147	263	225	855	74	76	78	298	0.203	2.83	0.07	19.9	0.015	1.0	6.34	1	50.9	14.9	99.8
466	365	338	186	189	146	251	222	856	71	75	73	297	0.201	2.77	0.09	19.9	0.013	1.0	6.25	0	50.1	15.0	100.0
471	370	340	190	179	149	259	223	861	75	68	75	298	0.204	2.72	0.09	19.9	0.017	1.0	6.11	3	50.7	15.3	99.5
476	375	339	181	186	143	255	221	872	75	79	75	296	0.205	2.68	0.06	19.9	0.012	1.0	6.01	-3	49.3	15.4	99.5
481	380	334	180	180	150	253	219	897	75	75	73	299	0.211	2.63	0.07	19.9	0.014	1.0	5.95	3	49.7	15.5	99.5
486	385	323	183	180	150	258	219	925	76	78	76	308	0.215	2.59	0.04	20.0	0.015	1.0	5.92	3	51.1	15.4	99.5
491	390	322	177	183	149	248	216	915	77	77	72	309	0.217	2.54	0.07	20.0	0.012	0.9	5.82	-3	51.4	15.6	99.5
496	395	324	181	179	149	246	215	855	78	76	74	302	0.205	2.52	0.07	19.9	0.011	1.0	5.93	1	50.4	15.7	99.8
501	400	329	180	175	143	253	216	835	77	75	77	294	0.201	2.45	0.07	19.9	0.011	1.1	5.84	1	48.4	15.9	99.9
506	405	324	183	183	143	257	218	834	74	74	74	294	0.200	2.40	0.07	19.9	0.017	1.0	5.66	7	50.3	16.3	99.0
511	410	327	180	176	137	251	214	829	73	71	73	293	0.200	2.36	0.07	19.9	0.017	1.1	5.45	5	49.0	16.8	99.2
516	415	323	178	176	144	248	214	827	72	78	72	284	0.201	2.31	0.09	19.9	0.016	1.0	5.34	3	50.1	17.0	99.5
521	420	322	174	174	144	250	213	819	74	72	70	287	0.200	2.27	0.07	19.9	0.017	1.0	5.22	3	49.1	17.2	99.5
526	425	327	173	173	145	249	214	764	75	77	73	281	0.184	2.24	0.07	19.9	0.015	1.0	5.60	1	49.7	16.6	99.8
528	427	326	176	176	140	248	213	754	72	76	76	274	0.185	2.20	0.09	19.9	0.013	1.0	5.66	-3	49.9	16.5	99.5

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %

* Real time data is presented at 5 minute intervals. Average values appearing in this report are based on more frequent measurements

Notes:

Results Table = Prototypes
Filename = DefCFB20201902261
Test Stand B Cat-Installed. Air lever on second mark up from closed.Fan on high.
P0-(kg)- Started 1hr pre-burn.
P31-(4.2kg)- Stir.
P62-(3.13kg)- Stir.
P99-(2.22kg)- Leveled and packed coal bed.
101-(2.18kg)- Doors and damper closed after loading.Air not touched on 2nd mark. Fan on high.

CAT

Stove Name: DefcFB2020 **Test Date:** 02/27/19 **Run #:** 1

Dilution Tunnel ∪ Factor: ∪ Barometer Start: ∪ End: ∪ in. hg.

PM Train 1	Pre-Test	Post-Test	24 hr	Final
Date / Time	7:30 AM	6:00 AM		6:00 AM
Probe #Q	.9761	.9764		.9767 g.
Filters #Q	.2344	.2378		.2380 g.
Gas Meter	785.730	888.350	O-Ring Residue =	g.

PM Train 2	Pre-Test	Post-Test	24 hr	Final
Probe				g.
Filters				g.
Gas Meter			O-Ring Residue =	g.

PM Emission Rate-

WET: .33 **g/hr**

Date: 2/28

FINAL: .38 **g/hr**

Date: 03/04

BURN RATE-

1.23 **kg/hr**

425 min's

DT - 790

285°

206°

PRE-TEST FUEL LOAD Kindling Weight: 2.72 kg

# of 2 x 4's: 28 # of 4 x 4's: X Length ='s: 8 In.

29.4165 Weight: 13.33 kg. Placed on: 1.46 kg. Coal Bed @ Record #: ∪

Air Setting Moved to: up on mark at 4.99 kg. Coal Bed @ Record #: 0

NOTES: Fan (on) / off High ↑ Charcoal Mark to a little higher B.R.

TEST FUEL LOAD

Stove Volume: 3.25 Cu. Ft. X 3.17 kg./Cu. Ft. = 10.263 kg.

Length: 20 In. # of 2 x 4's: X # of 4 x 4's: 4 # of Spacers: 12

Fuel Moisture

Rear 2x4 21. **Rear 4x4** 20.1 **Front 2x4** 22.2 **Front 4x4** 19.2

M.C. Dry = 100 / (100 / M.C. Wet – 1)

M.C. Wet = 100 x M.C. Dry / (100 + M.C. Dry)

Moisture Content: 20.63 % Dry Basis

Actual Fuel Weight: 10.50 kg. (Wet)

4.65 lbs

x 0.20 = 2.1 kg. (Low End Coal Bed Target)

x 0.25 = 2.625 kg. (High End Coal Bed Target)

5.75 lb.

NOTES:

Initial : D.W.

Prototypes | DefCFB2020 | 2/27/2019 | 1 | DefCFB20201902271

Results Table = Prototypes
Filename = DefCFB20201902271
Test Stand B Cat installed. Air. 2nd mark.(Moved up a little bit.)Fan on high.
P0-(kg)- Started 1hr pre-burn.

Tunnel B Factor = 0.93
Avg Tun Flow (scfm) 146.2

	Pre-Test	Post-Test							
Probe 1	0.9761	0.9767	Meter 1 Factor= 0.99					Stove	
Filters 1	0.2344	0.238							
O-Ring Residue =		0		Catch (mg)	Meter Temp (deg F)	Meter Volume (scf)	PM Conc (mg/scf)	PM Rate 1 (g/hr)	
Gas Meter 1	785.73	888.35		4.2	91.5	97.26	0.043	0.38	5G
Probe 2	0	0	Meter 2 Factor= 0.944						
Filters 2	0	0							
O-Ring Residue =		0		Catch (mg)	Meter Temp (deg F)	Meter Volume (scf)	PM Conc (mg/scf)	PM Rate 2 (g/hr)	
Gas Meter 2	0	0		0	76.9	0	0	0	5G

Time	11:07 AM	6:13 PM		Test Elapsed Time =	425	min
Record #	80	505		Dry Burn Rate =	1.23	kg/hr
Barometer	29.92	29.92	in Hg	Avg PM Rate =	0.38	g/hr
Lab Temp	75	69	deg F	Avg PM Factor =	0.31	g/kg
Avg Stove	285	206	deg F	EPA Avg A/F	64.8	
				Stove Delta T =	-79	deg F
				H.C. Factor =	0	g/kg as CH4
				CO Factor =	-0.2	g/kg
				TCC Efficiency =	-105.8	%
				Comb. Efficiency =	99.1	%
				Avg Stack T =	371.8	deg F

EPA Cat. 2

Wet Wood (kg)	Wood Moisture (dry %)	Coal Bed (kg)	Dry Wood (kg)
10.5	20.63	2.38	8.7

Avg Stack Gasses (Ambient Corrected)

Avg CO	-0.0001	Vol %
Avg CO2	0.56	Vol %
Avg O2	20.351	Vol %
Avg HC	0	Vol % as CH4
Avg TCC	0.0055	Vol % as CO2

Vermont Castings Group, Bethel **EMISSIONS TEST RESULTS REPORT** Results Table: Prototypes

Stove Name: DefCFB2020 Test Date: 2/27/2019 Run #: 1 File: DefCFB2020190 Record # Start 80 Stop 505

Test Time	425	min
Wet Wood	10.5	kg
Moisture	20.63	dry %
Dry Wood	8.70	kg
Coal Bed	2.38	kg
Stove DeltaT	-79	deg F
Tunnel CD	0.93	

Avg Stack Gasses (amb Corrected)

CO -0.000 %
CO2 0.56 %
O2 20.351 %
HC 0 % as CH4
TCC 0.0055 % as CO2

PM Trains - EPA 5G-3

	Catch mg	Vol scf	Tun Flow scfm	PM Rate 5g	Prec. %
Train 1	4.20	97.26	146.2	.38	n/a
Train 2	0	0		0	

Average Rate 5G 0.38 g/hr (5g)

Results

PM g/hr (5g)	PM g/kg (5g)	Dry Burn Rate kg/hr	EPA Cat.	EPA A/F	TCC Efficiency	CO g/kg	HC g/kg (CH4)
0.38	**0.31**	**1.23**	**2**	**64.8**	**-105.8**	**-0.2**	**0**

Heat Output **-24,900** Btu/hr (measured efficiency)

Real Time Data*

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %
0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	0.00	0.00	0.0	0.000	0.0	0.00	0	0.0	0.0	0.0
5	5	605	331	285	149	374	349	1139	77	72	74	361	0.306	4.65	-4.65	20.8	0.017	0.2	0.14	74	90.0	91.8	0.0
10	10	517	303	266	162	375	325	1329	73	71	77	405	0.333	4.44	0.39	20.8	0.019	0.1	0.12	-169	90.9	92.2	0.0
15	15	478	285	253	182	368	313	1329	70	68	70	444	0.355	4.24	0.39	20.8	0.017	0.1	0.14	0	91.0	91.8	100.0
20	20	452	265	237	207	369	306	1370	78	76	78	478	0.371	4.06	0.34	20.8	0.016	0.1	0.13	-237	90.8	91.9	0.0
25	25	433	260	223	227	364	301	1409	75	73	73	494	0.371	3.83	0.37	20.8	0.017	0.1	0.13	-99	91.0	92.1	0.0
30	30	418	246	222	240	368	299	1411	75	70	72	493	0.383	3.58	0.41	20.8	0.016	0.1	0.12	296	91.1	92.2	0.0
35	35	424	246	220	254	365	302	1463	76	74	76	506	0.412	3.36	0.45	20.8	0.016	0.1	0.12	296	91.1	92.2	0.0
40	40	433	240	218	259	368	303	1400	74	77	74	485	0.361	3.20	0.36	20.8	0.016	0.1	0.13	0	91.1	92.2	100.0
45	45	457	242	223	257	366	309	1333	79	79	75	442	0.318	3.04	0.29	20.8	0.017	0.1	0.13	-237	90.7	91.9	0.0
50	50	457	238	219	249	366	306	1269	75	77	77	423	0.308	2.90	0.23	20.8	0.018	0.1	0.13	-474	91.0	91.8	0.0
55	55	450	242	225	240	364	304	1214	75	79	75	409	0.300	2.81	0.18	17.3	0.032	3.6	12.37	2	25.7	9.0	99.7
60	60	437	242	226	231	376	302	1108	78	76	74	420	0.124	2.74	0.19	17.6	0.024	3.3	10.71	1	26.4	10.1	99.8
65	65	422	239	229	220	367	295	1224	72	74	74	398	0.296	2.59	0.20	18.3	0.020	2.6	15.51	1	31.2	7.2	99.8
70	70	411	240	227	216	364	292	1103	73	81	77	372	0.273	2.52	0.13	19.3	0.018	1.6	10.30	4	41.6	10.4	99.5
75	75	409	233	222	209	356	286	1040	78	76	72	356	0.256	2.47	0.09	19.4	0.016	1.5	9.76	2	43.2	10.9	99.6
80	0	407	227	225	201	357	284	1002	79	79	77	340	0.256	2.38	0.14	19.8	0.018	1.1	8.66	4	48.8	12.1	99.4
85	5	357	226	216	198	339	267	1164	72	74	74	370	0.288	12.79	-10.32	19.7	0.016	1.2	11.23	0	48.4	9.6	100.0
90	10	322	210	205	203	337	256	1276	75	77	77	400	0.306	12.63	0.25	19.4	0.013	1.5	13.83	-3	43.6	8.0	99.5
95	15	300	201	194	216	331	248	1299	74	74	76	424	0.324	12.45	0.29	19.6	0.011	1.3	13.29	-2	46.4	8.3	99.7
100	20	291	196	188	226	317	244	1322	74	76	74	437	0.335	12.27	0.32	19.6	0.017	1.3	14.15	2	47.4	7.9	99.7
105	25	289	188	192	229	315	243	1356	79	74	81	459	0.351	12.06	0.37	19.7	0.013	1.2	13.51	-1	48.4	8.2	99.9
110	30	285	187	183	243	319	244	1370	78	78	76	465	0.351	11.84	0.38	20.0	0.014	1.0	13.56	1	53.7	8.2	99.8
115	35	298	181	181	248	309	244	1377	77	77	77	472	0.356	11.63	0.39	20.0	0.011	0.9	14.15	-6	55.5	7.9	99.2
120	40	304	183	179	256	309	246	1414	76	78	76	486	0.364	11.41	0.38	19.9	0.011	1.1	14.54	0	52.4	7.7	100.0

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %
125	45	314	180	180	258	304	247	1446	80	73	78	494	0.375	11.13	0.43	19.9	0.012	1.0	15.48	-4	53.0	7.3	99.5
130	50	325	183	176	265	302	250	1469	76	78	76	507	0.382	10.88	0.46	19.8	0.013	1.2	15.80	2	50.2	7.1	99.7
135	55	343	185	187	280	304	260	1491	76	78	76	512	0.388	10.59	0.50	19.7	0.015	1.2	16.05	0	49.5	7.0	100.0
140	60	348	186	188	283	307	262	1502	81	72	79	517	0.391	10.32	0.50	19.7	0.016	1.2	16.33	5	49.9	6.9	99.2
145	65	368	193	191	282	303	267	1516	80	80	77	514	0.392	10.05	0.49	19.8	0.015	1.1	16.88	2	51.9	6.7	99.7
150	70	372	198	194	278	309	270	1519	76	79	76	508	0.388	9.75	0.48	20.0	0.016	0.9	17.25	1	56.1	6.6	99.8
155	75	387	196	201	283	302	274	1515	77	79	81	504	0.383	9.43	0.55	19.9	0.012	1.0	16.87	-3	53.3	6.7	99.6
160	80	387	198	203	283	306	275	1502	76	78	76	499	0.382	9.21	0.47	20.0	0.015	0.9	16.77	3	56.9	6.7	99.6
165	85	401	210	208	279	310	281	1511	77	79	77	505	0.381	8.91	0.50	19.9	0.016	1.0	17.25	5	53.7	6.6	99.3
170	90	405	196	207	281	313	280	1511	79	74	74	506	0.381	8.62	0.52	19.9	0.013	1.0	16.83	-3	54.0	6.7	99.6
175	95	413	214	210	277	311	285	1528	83	81	75	515	0.383	8.39	0.48	20.0	0.016	0.9	17.26	3	55.9	6.6	99.6
180	100	422	210	212	290	318	290	1535	81	81	77	502	0.385	8.10	0.47	19.9	0.016	1.0	18.51	1	53.9	6.2	99.8
185	105	434	217	217	293	315	295	1540	80	80	80	508	0.384	7.82	0.50	19.9	0.015	1.0	18.02	0	53.7	6.3	100.0
190	110	433	223	216	292	316	296	1509	77	79	79	498	0.380	7.55	0.50	20.0	0.014	0.9	17.94	-4	56.4	6.3	99.4
195	115	437	222	226	289	320	299	1504	85	81	81	497	0.376	7.30	0.46	20.0	0.018	1.0	17.07	4	54.6	6.6	99.4
200	120	450	220	226	289	317	300	1487	81	81	76	491	0.371	7.07	0.46	20.1	0.014	0.9	16.22	-3	57.5	6.9	99.6
205	125	450	226	226	285	324	302	1485	81	78	78	491	0.366	6.83	0.45	20.1	0.014	0.8	16.22	2	57.5	7.0	99.8
210	130	446	229	229	287	318	302	1468	81	81	79	482	0.367	6.60	0.43	20.1	0.017	0.9	15.65	6	56.7	7.2	99.1
215	135	434	230	228	284	323	300	1508	78	78	78	493	0.372	6.37	0.41	20.1	0.016	0.8	18.04	5	57.7	6.3	99.3
220	140	437	231	233	293	320	303	1483	78	78	78	480	0.367	6.12	0.43	20.2	0.014	0.7	17.99	-7	61.0	6.2	99.0
225	145	443	230	230	291	326	304	1487	78	78	80	486	0.367	5.85	0.45	20.2	0.017	0.8	17.67	0	60.0	6.4	100.0
230	150	431	234	236	290	320	302	1488	79	79	81	490	0.364	5.62	0.43	20.2	0.015	0.7	17.22	4	61.5	6.6	99.5
235	155	428	228	231	287	319	299	1451	72	78	81	471	0.354	5.42	0.38	20.3	0.015	0.6	15.80	6	63.5	7.1	99.1
240	160	434	234	234	288	321	302	1384	82	84	80	451	0.318	5.26	0.32	20.5	0.013	0.5	13.60	6	69.8	8.1	99.2
245	165	441	242	248	274	320	305	1314	81	83	81	431	0.320	5.10	0.30	20.5	0.013	0.4	12.54	-6	71.4	8.7	99.1
250	170	446	240	240	259	325	302	1289	79	79	81	422	0.315	4.97	0.25	20.5	0.012	0.4	12.66	-3	70.2	8.7	99.6
255	175	452	241	237	248	322	300	1255	78	81	76	413	0.303	4.83	0.25	20.4	0.008	0.5	12.52	-15	67.7	8.8	97.8
260	180	455	236	247	249	321	302	1246	77	86	80	410	0.293	4.72	0.25	20.5	0.013	0.4	12.58	6	71.0	8.7	99.1
265	185	468	242	236	240	318	301	1237	79	81	77	403	0.281	4.60	0.21	20.4	0.012	0.5	12.70	5	66.8	8.7	99.3
270	190	472	242	246	238	320	304	1206	77	81	81	394	0.283	4.49	0.20	20.4	0.011	0.5	11.80	-8	67.6	9.2	98.9
275	195	459	242	242	225	316	297	1136	81	83	79	381	0.273	4.40	0.18	20.6	0.010	0.3	10.61	4	73.8	10.1	99.5
280	200	455	238	238	223	307	292	1082	75	79	75	366	0.263	4.33	0.14	20.6	0.011	0.3	10.07	0	76.5	10.6	100.0
285	205	449	236	238	200	310	287	1036	78	80	75	355	0.251	4.24	0.11	20.7	0.012	0.2	9.56	0	78.4	11.1	100.0
290	210	448	238	227	201	316	286	994	75	81	77	346	0.241	4.20	0.11	20.7	0.009	0.2	9.29	-27	78.6	11.4	96.2
295	215	440	239	239	193	299	282	954	78	80	76	334	0.233	4.13	0.09	20.7	0.009	0.2	8.94	-18	79.7	11.8	97.4
300	220	436	234	232	184	303	278	937	75	75	77	329	0.226	4.08	0.09	20.7	0.015	0.2	8.92	11	78.3	11.8	98.4
305	225	427	229	231	175	314	275	928	75	81	73	325	0.225	4.04	0.09	20.7	0.009	0.2	8.96	-5	78.6	11.7	99.2
310	230	409	225	227	177	300	268	922	73	79	75	320	0.221	3.97	0.11	20.7	0.010	0.3	9.00	-33	77.1	11.7	95.3
315	235	412	222	226	172	302	267	910	72	74	72	315	0.215	3.95	0.06	20.7	0.013	0.2	9.09	17	78.9	11.6	97.6
320	240	409	222	222	164	298	263	909	72	77	77	322	0.215	3.88	0.09	20.7	0.013	0.2	9.22	-22	78.4	11.4	96.9
325	245	404	218	218	168	300	262	901	74	77	77	311	0.214	3.83	0.09	20.7	0.018	0.2	9.37	43	78.1	11.2	94.0
330	250	399	217	215	161	297	258	896	78	76	78	310	0.209	3.79	0.09	20.8	0.011	0.2	8.92	-42	82.7	11.7	94.1
335	255	397	212	221	161	292	257	893	75	77	73	310	0.209	3.76	0.07	20.7	0.014	0.2	8.84	-15	77.3	11.8	97.9
340	260	395	213	213	161	295	255	883	74	78	76	310	0.208	3.72	0.07	20.7	0.013	0.3	8.60	10	76.9	12.1	98.6
345	265	392	210	206	154	297	252	860	75	80	75	301	0.205	3.67	0.07	20.7	0.012	0.3	8.51	-10	76.9	12.2	98.6
350	270	386	208	206	154	293	250	831	76	78	71	301	0.198	3.63	0.07	20.7	0.008	0.2	8.27	-36	78.2	12.5	94.9
355	275	388	206	206	156	281	247	827	75	77	73	294	0.195	3.61	0.06	20.7	0.009	0.3	8.33	-24	77.1	12.4	96.6

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %
360	280	379	199	201	148	283	242	827	71	75	71	290	0.196	3.56	0.05	20.7	0.013	0.2	8.33	9	76.5	12.3	98.7
365	285	379	201	199	147	281	241	814	72	72	70	294	0.192	3.51	0.07	20.7	0.014	0.2	8.20	10	77.3	12.5	98.6
370	290	374	198	198	143	283	239	805	77	74	74	287	0.190	3.47	0.07	20.7	0.013	0.2	8.07	10	76.9	12.7	98.6
375	295	369	196	194	144	282	237	799	74	76	74	282	0.188	3.45	0.06	20.6	0.017	0.3	8.06	26	75.7	12.7	96.3
380	300	361	200	198	140	276	235	782	74	76	76	285	0.186	3.40	0.07	20.6	0.012	0.3	7.78	-16	74.6	13.0	97.7
385	305	367	200	194	142	278	236	771	72	78	70	278	0.180	3.36	0.06	20.7	0.019	0.3	7.79	17	75.2	13.0	97.6
390	310	358	198	187	142	282	234	765	76	74	78	280	0.179	3.33	0.07	20.6	0.017	0.3	7.79	4	73.0	13.0	99.5
395	315	356	193	185	137	273	229	767	71	73	76	273	0.181	3.29	0.07	20.6	0.013	0.3	7.68	4	75.0	13.2	99.4
400	320	345	189	178	142	276	226	779	71	78	76	276	0.182	3.24	0.07	20.7	0.014	0.3	7.75	-4	75.9	13.0	99.4
405	325	346	198	183	136	267	226	782	74	76	74	278	0.183	3.20	0.09	20.6	0.017	0.3	7.76	0	74.4	13.0	100.0
410	330	338	189	187	139	269	224	777	73	73	73	277	0.181	3.15	0.09	20.7	0.019	0.3	7.74	15	73.9	13.0	97.8
415	335	343	191	174	138	265	222	765	74	74	74	273	0.179	3.15	0.05	20.6	0.016	0.4	7.74	0	70.2	13.0	100.0
420	340	340	187	178	137	262	221	746	73	76	71	273	0.173	3.08	0.09	20.6	0.015	0.3	7.54	0	72.3	13.3	100.0
425	345	343	191	180	135	267	223	744	71	73	76	271	0.172	3.04	0.09	20.6	0.016	0.4	7.50	3	71.0	13.4	99.5
430	350	338	191	175	130	268	221	743	71	77	75	264	0.171	2.99	0.07	20.6	0.015	0.4	7.55	-12	70.2	13.3	98.3
435	355	338	188	171	130	262	218	739	73	77	73	264	0.171	2.95	0.09	20.6	0.015	0.4	7.47	-3	71.0	13.4	99.5
440	360	333	190	175	132	257	217	736	72	76	72	268	0.168	2.93	0.04	20.6	0.016	0.3	7.50	-10	71.4	13.4	98.6
445	365	347	191	168	131	254	218	731	74	74	71	263	0.168	2.86	0.09	20.5	0.017	0.4	7.56	3	69.3	13.3	99.6
450	370	336	191	170	131	250	216	731	74	74	71	263	0.165	2.83	0.10	20.6	0.017	0.4	7.35	-6	70.2	13.6	99.1
455	375	332	187	172	127	254	214	729	72	78	74	263	0.170	2.79	0.09	20.6	0.015	0.4	7.21	-3	70.2	13.8	99.6
460	380	334	185	167	129	247	212	727	69	78	73	260	0.167	2.77	0.06	20.5	0.017	0.4	7.27	0	67.9	13.7	100.0
465	385	329	186	167	126	253	212	732	73	73	71	266	0.168	2.72	0.07	20.6	0.018	0.3	7.57	3	71.4	13.2	99.5
470	390	329	180	163	130	245	209	741	75	73	71	268	0.170	2.68	0.06	20.6	0.017	0.3	7.96	-3	71.4	12.7	99.5
475	395	333	184	164	130	244	211	749	75	66	73	266	0.172	2.63	0.09	20.6	0.015	0.4	8.06	-13	71.0	12.6	98.2
480	400	325	186	163	131	240	209	756	75	75	71	264	0.174	2.59	0.09	20.5	0.020	0.4	8.17	5	68.1	12.4	99.2
485	405	320	186	156	128	242	206	768	75	77	73	268	0.178	2.56	0.07	20.5	0.022	0.4	8.29	14	69.1	12.3	97.9
490	410	322	179	164	128	246	208	784	72	74	72	270	0.180	2.52	0.07	20.5	0.019	0.4	8.24	5	68.5	12.3	99.2
495	415	324	186	169	132	244	211	782	72	75	70	270	0.180	2.47	0.07	20.5	0.018	0.4	8.19	3	69.3	12.4	99.6
500	420	318	180	169	128	242	208	766	73	77	73	273	0.178	2.43	0.09	20.5	0.018	0.4	7.89	3	67.8	12.8	99.6
505	425	317	179	164	136	233	206	751	72	70	72	270	0.177	2.38	0.07	20.5	0.019	0.4	7.48	0	69.3	13.4	100.0

Rec #	Tst .ET	Top Tmp F	Rht Avg F	Lft Tmp F	Bak Tmp F	Bot Tmp F	Avg Stove F	Ext1 F	Ext2 F	Ext3 F	Ext4 F	Stk Tmp F	Stk Drft "H2O	Scale kg	10min Drop kg	Stk .O2 %	Stk CO %	Stk CO2 %	Inc CO2 %	CO Fac g/kg	Stk AF	Inc AF	Comb Effic %

* Real time data is presented at 5 minute intervals. Average values appearing in this report are based on more frequent measurements

Notes:

Results Table = Prototypes
Filename = DefCFB20201902271
Test Stand B Cat Installed. Air. 2nd mark.(Moved up a little bit.)Fan on high.
P0-(kg)- Started 1hr pre-burn.
P30-(3.58kg)- Stir.
P52-(2.88kg)- Draft set.Analyzers on.
P60-(2.68kg)- Stir.
P76-(2.47kg)- Leveled and packed coal bed.
80-(2.38kg)- Damper and doors closed after loading.Air not touched.Fan on high.

Wood Heater Conditioning Data - ASTM E2780/ ASTM E2515

Manufacturer:	Hearth & Home
Model:	Defiant 1975-CAT-C
Tracking No.:	2366
Project No.:	0135WS043E
Test Date:	Feb 13 - Feb 27, 2019
Technician:	Dan - Hearth & Home
Operation Category:	Medium

Elapsed Time (hr)	Flue Gas Temp (° F)	Catalyst Exit Temp (° F)
0	375.0	1202.0
1	331.0	1034.0
2	372.0	1201.0
3	428.0	1454.0
4	455.0	1456.0
5	373.0	1234.0
6	293.0	879.0
7	261.0	791.0
8	252.0	784.0
9	258.0	829.0
10	242.0	781.0
11	231.0	707.0
12	208.0	580.0
13	403.0	1169.0
14	359.0	1166.0
15	368.0	1269.0
16	420.0	1410.0
17	443.0	1412.0
18	323.0	997.0
19	282.0	877.0
20	270.0	888.0
21	257.0	835.0
22	241.0	769.0
23	236.0	752.0
24	352.0	1057.0
25	412.0	1263.0

Elapsed Time (hr)	Flue Gas Temp (° F)	Catalyst Exit Temp (° F)
26	401.0	1317.0
27	468.0	1524.0
28	448.0	1433.0
29	322.0	931.0
30	283.0	845.0
31	274.0	824.0
32	257.0	755.0
33	394.0	1177.0
34	456.0	1387.0
35	448.0	1352.0
36	506.0	1547.0
37	473.0	1478.0
38	369.0	1164.0
39	311.0	880.0
40	293.0	854.0
41	308.0	925.0
42	361.0	1139.0
43	420.0	1224.0
44	494.0	1446.0
45	508.0	1540.0
46	431.0	1314.0
47	325.0	928.0
48	294.0	814.0
49	271.0	744.0
50	268.0	768.0

Technician Signature:_____

Stove Defiant 2020

Vol= 3.25 cu. ft.
Load Weight 21.5 kg
Wood Length 20 in

04/08/19

	Low	Med. Low	Med. High	High
Control Setting	Closed	11	Between 2nd & Third Mark	Wide Open
Kindling	5-6 (lb) kg	5-6 (lb) kg	5-6 (lb) kg	5-6 (lb) kg
Pre-burn Load Size 8 in (2x4)	29.5 (lb) kg	29.5 (lb) kg	29.5 (lb) kg	29.5 (lb) kg
Pre-Shutdown instructions	Burn down to 10 lbs then close down	Burn down to 10 lbs then close down	Burn down to 12 lbs then close down	Burn down to 12 lbs then close down
Shutdown Weight	10 (lb) kg	10 (lb) kg	12 (lb) kg	12 (lb) kg
Post-Shutdown Instructions	Stir between 20-30 mins Then 50-60 mins	Stir 20-30 mins & then 50-60 mins	Stir 20-30 mins & then 50-60 mins	Stir 20-30 mins & then 50-60 mins
Loading Temp deg F	300 +/-	300 +/-	325 +/-	325 +/-
Results	AVG B.R. .84-.93 AVG Catch .27 g/hr to .60 g/hr	AVG B.R. .93-1.04 AVG Catch .30 g/hr to .60 g/hr	AVG B.R. 1.37-1.44 AVG Catch .45 g/hr to .73 g/hr	AVG B.R. 1.70-1.79 AVG Catch 2.75 g/hr to 4.65 g/hr

Burn Instructions for both CAT & NON-CAT

(ATT: Bruce Davis)

Pre-Burn! Load All of Pre-burn weight. Crack doors and leave damper open until weight is at 22 lbs. Then close doors, (leave damper open,) AT SHUT DOWN WEIGHT, Close damp, SET Air for B.R. Make sure fan is on High or Low as needed.

Pack coal bed well
Be sure wood is up against back refractory
Make sure there is an air-way under fresh wood Thru coals
Do not block entire exhaust openings

I found out stove seems to work better when:

Appendix F – Labeling & Owner's Manual

MODEL / MODÈLE: “Defiant® Model 1975-CAT-C”
LISTED SOLID FUEL ROOM HEATER BURNING FIREPLACE STOVE
HOMOLOGUE POELE A COMBUSTIBLE SOLIDES

Serial No.
N° de série: HF

BARCODE LABEL

Report #/Rapport #0135WS043S / 0135ES043E

Tested to / Testé à: ASTM E2515, ASTM E2780, UL 1482-2011, ULC-S627-00, CAN/CSA B415.1

NOT APPROVED FOR USE IN MOBILE HOMES IN THE U.S. AND CANADA.

Install and use only in accordance with manufacturer’s installation and operation instructions. Contact local building or fire officials about restrictions and installation inspection in your area. Install only with legs provided in accordance with installation instructions.

WARNING: Risk of flame and smoke spillage. Do not obstruct the space beneath the heater.

Fuel: Use with solid wood fuel only. Do not burn other fuels. Build a fire directly on hearth only. Do not elevate fire. Keep doors fully closed while operating.

Chimney: Use a minimum 6” or 8” diameter factory built high temperature (H.T.) chimney which is listed to UL-103 (2100° F) or 8” X 8” nominal or larger approved masonry chimney with flue liner. Inspect and clean chimney frequently - under certain conditions of use, creosote buildup may occur rapidly.

DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVICING ANOTHER APPLIANCE

Chimney Connector: Use a minimum 6” or 8” diameter 24 gauge chimney connector. Install chimney connector at least 30” from ceiling. Refer to local building codes and Vermont Castings Owner’s Guide for special precautions for passing a chimney or chimney connector through a combustible wall or ceiling.

Floor Protection: The Defiant does not require R value floor protection. The minimum floor protector material is 20 gauge sheet metal. Other floor protector materials that can be used include: Type I hearth pads, ceramic tile, stone, brick, etc. Protection requirements vary somewhat between the Untied States and Canada.

Optional Components: Fan Kit Part No. FK26. 115V 60Hz 1.1 FLA

Replace glass only with Vermont Castings 5mm ceramic glass.

Do not remove or cover this label. **Catalytic Combustor Part No. 30005353**

CAUTION: Burning of materials other than the specified fuels may make the Catalyst in the combustor inactive. The combustor is fragile, handle carefully.

Combustion air cannot be obstructed. Damper must be open before opening doors. Do not overfire. Glowing parts indicate overfiring.The space heater must be installed with the legs provided, attached as shown in the installation instructions.

Installez et utilisez uniquement conformément aux instructions d’installation et d’utilisation du fabricant. Contactez les responsables locaux de la construction ou les services d’incendie pour connaître les restrictions et l’inspection de l’installation dans votre région. Installez uniquement avec les pieds fournis conformément aux instructions d’installation.

Avertissement: Risque de flammes et de fumée. Ne pas obstruer l’espace sous le radiateur.

Combustible: Utilisez uniquement du combustible à bois solide. Ne brûlez pas d’autres combustibles. Construire un feu directement sur le foyer seulement. Ne pas élever le feu. Gardez les portes complètement fermées pendant le fonctionnement.

Cheminée: Utilisez une cheminée haute température (H.T.) construite en usine et d’un diamètre minimum de 6 ”ou 8”, qui est homologuée UL-103 (2100 ° F) ou une cheminée en maçonnerie nominale ou supérieure approuvée de 8 ”X 8” avec conduit de cheminée. Inspectez et nettoyez fréquemment la cheminée - dans certaines conditions d’utilisation, une accumulation de créosote peut se produire rapidement.

Ne connectez pas cet appareil à un conduit de cheminée desservant un autre appareil

Raccord de cheminée: Utilisez un raccord de cheminée de calibre 24 minimum de 6 ”ou 8” de diamètre. Installez le raccord de cheminée à au moins 30 po du plafond. Reportez-vous aux codes du bâtiment locaux et au Guide du propriétaire de Vermont Castings pour connaître les précautions particulières à prendre pour faire passer une cheminée ou un connecteur de cheminée à travers un mur ou un plafond inflammable.

Protection de sol: Defiant ne nécessite pas de protection de plancher de valeur R. Le matériau de protection de plancher minimum est une tôle de calibre 20. Parmi les autres matériaux de protection de sol pouvant être utilisés, citons: les coussinets de foyer de type I, les carreaux de céramique, la pierre, la brique, etc.

Composants facultatifs: kit de ventilateurs (réf. FK26). 115V 60Hz 1.1 FLA

Remplacez le verre uniquement par du verre en céramique de 5 mm Vermont Castings.

Ne pas enlever ni recouvrir cette étiquette. Système de combustion catalytique N ° de pièce 30005353

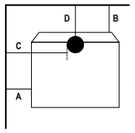
Attention: La combustion de matériaux autres que les carburants spécifiés peut rendre le catalyseur dans la chambre de combustion inactif. La chambre de combustion est fragile, manipulez-la avec précaution.

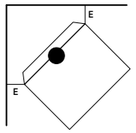
CAUTION: HOT WHILE IN OPERATION- DO NOT TOUCH- KEEP CHILDRENAND CLOTHING AWAY- CONTACT MAY CAUSE SKIN BURNS- SEE NAMEPLATE AND INSTRUCTIONS. KEEP FURNISHINGS AND OTHERCOMBUSTIBLE MATERIALS A CONSIDERABLE DISTANCE AWAY FROM THE APPLIANCE

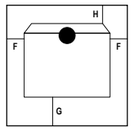
ATTENTION: CHAUD LORS DU FONCTIONNEMENT- NE TOUCHEZ PAS L’APPAREIL-GARDEZ LES ENFANTS ET LES VÊTEMENTS ÉLOIGNÉS- TOUT CONTACT PEUT ENTRAÎNER DES BRÛLURES DE LA PEAU. RÉFÉREZ-VOUS À LA PLAQUE SIGNALÉTIQUE ET AU MODE D’EMPLOI. GARDEZ LE MOBILIER ET LES AUTRES MATÉRIAUX COMBUSTIBLES BIEN À L’ÉCART DE L’APPAREIL.

US ENVIRONMENTAL PROTECTION AGENCY

Certified to comply with 2020 US EPA particulate emissions standards at 1.3 g/hr. This wood heater contains a catalytic combustor which needs periodic inspection and replacement for proper operation. Consult the Owner’s Manual for further information. It is against Federal Regulations to operate this wood heater in a manner inconsistent with operating instructions in the Owner’s Manual.







MINIMUM FLOOR PROTECTION

*Less than 3/4” (19mm) protrusion. For additional types of installations and clearabces consult your Owner’s Manual. Por autres modes d’installation et degagement supplementaires, consultz votres manual du proprietaire.

Most vertical installations require a ceiling heat shield and a flue collar heat shield to be installed. Consult your Owner’s Manual.

MINIMUM CLEARANCES TO COMBUSTIBLE CONSTRUCTION / MINIMUM DE DEGAGEMENT JUSQU’A LA CONSTRUCTION COMBUSTIBLE

A = Unit to Sidewall	21”
B = Unit to Backwall	15”
C = Chimney Connector to Sidewall	32”
D = Chimney Connector to Backwall	17”
E = Unit to Adjacent Wall	5”
F = Sides	6”
G = Front to Glass	16”
H = Rear	6”

A = Entre le mur lateral et l’appareil	533mm
B = Entre le mur arriereet l’appareil	381mm
C = Entre le tuyau et le mur lateral	813mm
D = Entre le tuyau et le mur arriere	432mm
E = Entre le mur adjacent et l’appareil	127mm
F = Côtés	203mm
G = Devant, par rapport au verr	457mm
H = Arrière	203mm

VERMONT CASTINGS

Made in U.S.A. of US and imported parts.
Fabriqué aux États-Unis-d’Amérique par des pièces d’origine américaine et pièces importées.

Date of Manufacture / Date de fabrication:

2019	2020	2021	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Manufactured by / Fabriqué par: Hearth and Home Technologies 352 Mountain House Road, Halifax PA 17032

8390-976_R1

LABEL TICKET			
ECO:	89916	**LABEL SIZE:**	4.25” H x 15.75” W
PART # / REV:	8390-976	**ADHESIVE:**	
ORIGINATOR:	Spidlet	**MATERIAL:**	24 Gauge Aluminum
DATE:	05/23/19	**INK:**	Black and Red
HEARTH & HOME technologies® 352 Mountain House Road Halifax, PA 17032		(4) Holes = .156 x .250 Corners .062 Barcode label must have the serial number on it. The barcode label must be able to read Code 39 Full ASCII.	

Installation & Operating Manual

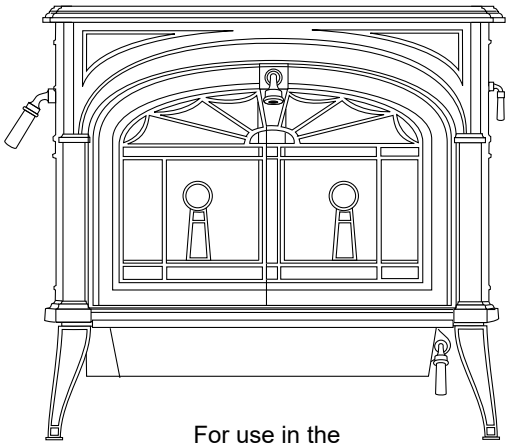
Installation and Appliance Setup - Care and Operation

INSTALLER: Leave this manual with party responsible for use and operation.
OWNER: Retain this manual for future reference.
Call your dealer for questions on Installation, Operation, or Service.

NOTICE: SAVE THESE INSTRUCTIONS

VERMONT CASTINGS™

Defiant® Model 1975-CAT-C
Wood Burning Stove



For use in the
United States and Canada

NATIONAL FIREPLACE INSTITUTE NFI CERTIFIED www.nficertified.org

We recommend that our woodburning hearth products be installed and serviced by professionals who are certified in the U.S. by the National Fireplace Institute® (NFI) as NFI Woodburning Specialists or who are certified in Canada by Wood Energy Technical Training (WETT).

Wood Energy Technical Training

SAFETY NOTICE: IF THIS APPLIANCE IS NOT PROPERLY INSTALLED, OPERATED AND MAINTAINED, A HOUSE FIRE MAY RESULT.

TO REDUCE THE RISK OF FIRE, FOLLOW THE INSTALLATION INSTRUCTIONS. FAILURE TO FOLLOW INSTRUCTIONS MAY RESULT IN PROPERTY DAMAGE, BODILY INJURY OR EVEN DEATH. CONTACT LOCAL BUILDING OFFICIALS ABOUT RESTRICTIONS AND INSTALLATION INSPECTION REQUIREMENTS IN YOUR AREA.

⚠ WARNING

Please read this entire manual before installation and use of this wood-burning room heater.
Failure to follow these instructions could result in property damage, bodily injury or even death.

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- Do not overfire - If any external part starts to glow, you are overfiring. Close air controls. Overfiring will void your warranty.
- Comply with all minimum clearances to combustibles as specified. Failure to comply may cause a house fire.

⚠ CAUTION

Tested and approved for use with dry, seasoned cordwood only. Do Not Burn Wet or Green Wood. Burning any other type of fuel will void your warranty.

Installation and service of this appliance should be performed by qualified personnel. Hearth & Home Technologies recommends HHT Factory Trained or NFI certified professionals.

hearthED FACTORY TRAINING Fuel Your Fire

NFI NATIONAL FIREPLACE INSTITUTE A CERTIFICATION AGENCY

The French language version of this manual is available online: www.vermontcastings.com
La version française de ce manuel est disponible en ligne : www.vermontcastings.com

Congratulations on your choice of a Vermont Castings Defiant® Model 1975-CAT-C stove. With this purchase you have made a commitment to make the hearth a place of warmth, beauty and comfort in your home. At Vermont Castings, we share that joy and appreciation for the hearth. We assure you that your cast-iron Vermont Castings stove has been made with the utmost care and will provide you with many years of service.

As you become acquainted with your new stove, you will find that its appearance is matched by its functionality, due to cast iron's unique ability to absorb and radiate heat.

Also, Vermont Castings products are among the cleanest-burning wood stoves available today. However, clean burning depends on both the manufacturer and the operator. Please read this manual carefully to understand how to properly operate and maintain your stove.

At Vermont Castings, we are equally committed to your satisfaction as a customer. That is why we maintain an exclusive network of the finest dealers in the industry. Our dealers are chosen for their expertise and dedication to customer service. They are factory-trained and knowledgeable about every Vermont Castings product. Feel free to contact your Authorized Vermont Castings Dealer anytime you have a particular question about your stove or its performance.

This manual contains valuable instructions on the installation and operation of your Vermont Castings Defiant® Model 1975-CAT-C. It also contains useful information on maintenance. Please read the manual thoroughly and keep it as a reference.

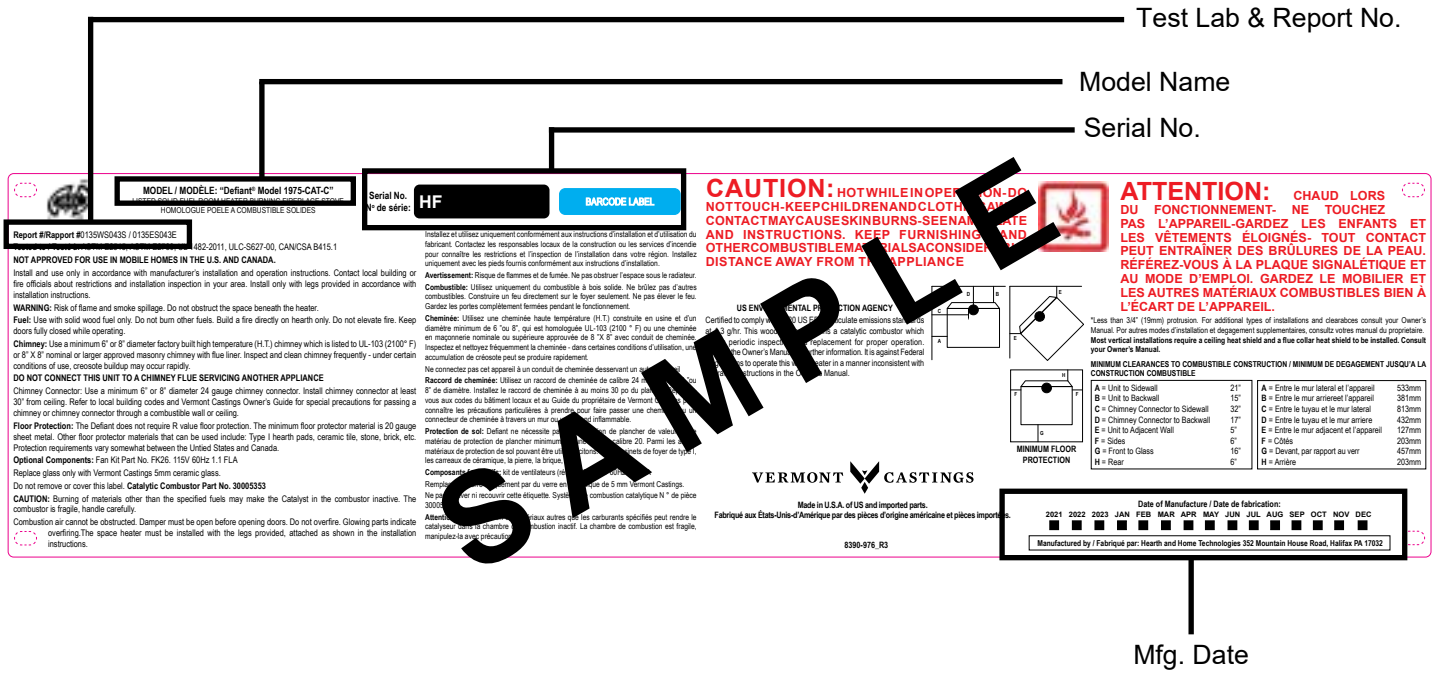
Please read this entire manual before you install and use your new stove. Failure to follow instructions may result in property damage, bodily injury, or even death.

Note: Cast iron is an artisan crafted material, which is made the same way today as nearly 2000 years ago. Due to the intrinsic primitive nature of the casting process, part to part variation is normal and adds to the character of a hand built cast iron appliance.

US ENVIRONMENTAL PROTECTION AGENCY

Certified to comply with 2020 particulate emission standards using crib wood

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



⚠ Safety Alert Key:

- ***DANGER!*** Indicates a hazardous situation which, if not avoided will result in death or serious injury.
- ***WARNING!*** Indicates a hazardous situation which, if not avoided could result in death or serious injury.
- ***CAUTION!*** Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
- ***NOTICE:*** Indicates practices which may cause damage to the appliance or to property.

TABLE OF CONTENTS

➔ = Contains updated information

1 Product Specific and Important Safety Information

A. Appliance Certification

MODEL:	Defiant® Model 1975-CAT-C
LABORATORY:	OMNI Test Laboratories, Inc
REPORT NO.	0135WS043S / 0135WS043E
TYPE:	Solid Fuel Room Heater / Wood Burning Type
STANDARD(s):	ASTM E2515, ASTM E2780, UL1482, ULC-S627-00, CAN/CSA B415.1
ELECTRICAL RATING:	115 VAC, 60 Hz

Area Heated.....1,300 to 2,800 Square feet

Loading.....Front and top

Chimney Connector: .....
for 6" flue collar .....6" (152 mm) diameter
for 8" oval flue collar.....8" (203 mm) diameter

Flue Exit Position .....Top or Rear

Primary Air ..... Manually set, thermostatically maintained

Secondary Air .....Fixed, self-regulating

Ash Handling System..... Removable ash pan

Glass Panels .....High-temperature ceramic

Weight.....475 lbs. (215 kg.)

B. California Safety Information

⚠ WARNING

This product and the fuels used to operate this product (wood), and the products of combustion of such fuels, can expose you to chemicals including carbon black, which is known to the State of California to cause cancer, and carbon monoxide, which is know to the State of California to cause birth defects or other reproductive harm. For more information go to: www.P65Warnings.ca.gov

Proposition 65 Warning: Fuels used in gas, woodburning or oil fired appliances, and the products of combustion of such fuels, contain chemicals known to the State of California to cause cancer, birth defects and other reproductive harm.

California Health & Safety Code Sec. 25249.6

C. BTU & Efficiency Specifications

EPA Certification Number:	212-19
EPA Certified Emissions:	1.3 g/hr
***LHV Tested Efficiency:**	84.1%
****HHV tested Efficiency:**	77.9%
*****EPA BTU Output:**	12,000 - 24,500
******Peak BTU/Hour Output:**	56,000
Other Important Information	
Vent Size:	6 Inch (152 mm) 8 Inch (203 mm)
Firebox Size:	3.25 cu. ft.
Max. Wood Length:	25" Maximum
Ideal Wood Length:	20" (Top Load)
Fuel	Seasoned Cordwood (20% moisture)
*Weighted average LHV efficiency using Douglas Fir dimensional lumber and data collected during EPA emissions test.	
**Weighted average HHV efficiency using Douglas Fir dimensional lumber and data collected during EPA emissions test.	
***Efficiencies are based on test results calculated using B415; these calculated efficiencies are then used to calculate output BTU's.	
******A peak BTU out of the appliance calculated using the maximum first hour burn rate from the High EPA Test and the BTU content of cord wood (8600) times the efficiency.	

D. Stove Dimensions

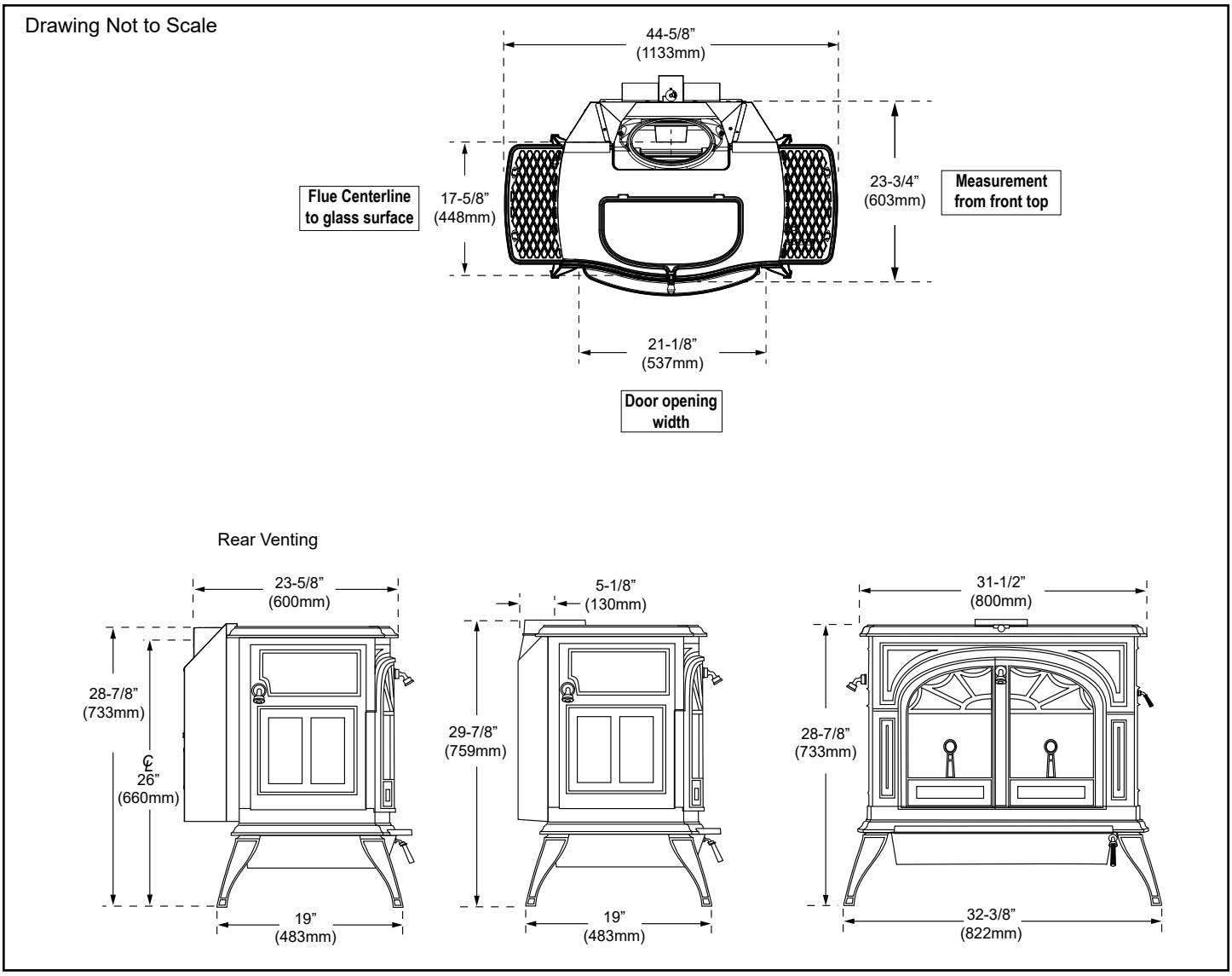


Figure 1.1

2 Important Safety Information

SAFETY NOTICE: IF YOUR APPLIANCE IS NOT PROPERLY 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.

Before you begin an installation, be sure that:

- Your stove and chimney connector will be far enough from combustible material to meet all clearance requirements.
- The floor protector is large enough and is constructed properly to meet all requirements.
- You have all necessary permits from local authorities.

Your local building official is the final authority for approving your installation as safe and determining that it meets local and state codes.

The metal label permanently attached to the back of every Vermont Castings' stove indicates that the stove has been tested to current UL and ULC standards, and gives the name of the testing laboratory. Clearance and installation information also is printed on the label. When the stove is installed according to the information both on the label and in this manual, local authorities usually will accept the label as evidence that the installation meets codes and can be approved.

However, codes vary in different areas. Before starting the installation, review your plans with the local building authority. Your local dealer can provide any additional information needed.

For any unresolved installation issues, refer to the National Fire Protection Association's publication ANSI/NFPA 211 Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances. For Canada, the equivalent publication is CSA CAN-B365 Installation Code for Solid Fuel Burning Appliances and Equipment. These standards are the basis for many national codes. They are nationally recognized and are accepted by most local authorities. Your local dealer or your local building official may have a copy of these regulations.

IMPORTANT: Failure to follow these installation instructions may result in a dangerous situation, including a chimney or house fire. Follow all instructions exactly, and do not allow makeshift compromises to endanger property and personal safety.

A. Outside Air

A source of air (oxygen) is necessary in order for combustion to take place. Whatever combustion air is consumed by the fire must be replaced. Air is replaced via air leakage around windows and under doors. In homes that have tightly sealed doors and windows, an outside air source is needed. An optional outside air kit is available

Items Needed for Installation (not supplied)

- Outside air adapter (available at your authorized Vermont Castings dealer)
- Phillips head screw driver
- Silicone sealant
- 3" Flex or Rigid Duct
- 3" Outside Air Termination Cap with Screen
- Hose Clamps
- Drills and saws necessary for cutting holes through the wall or flooring in your home.

1. Using a #2 Phillips screw driver attach the flex adapter to the appliance using 4 screws.
2. Floor & Rear Installation: Cut a 3" (76 mm) hole in outside wall or floor to accommodate outside air piping. Use 3" (76 mm) aluminum metal flex or rigid piping to directly connect outside air to appliance intake. Use the supplied termination cap with a rodent screen. Seal between the wall (or floor) and the pipe with silicone to prevent moisture penetration.

When poor draft is caused by a low infiltration rate, opening a ground floor window on the windward side of the house and near the stove will usually alleviate the problem.

A better solution is to install a permanent outside air supply to the stove and/or room. In fact, bringing air for combustion from outside the home directly to the air inlet of the stove is required for new construction in some areas.

B. Types of Chimney to Use

You must connect this appliance to a code-approved masonry chimney with a flue liner, to a relined masonry chimney that meets local codes, or to a prefabricated metal chimney that complies with the requirements for Type HT chimneys in the Standard for Chimneys, Factory-Built, Residential Type and Building Heating Appliance, UL 103. Figure 2 illustrates the two types. The chimney and chimney connector must be in good condition and kept clean.

If you use an existing masonry chimney, it must be inspected to ensure it is in a safe condition before the stove is installed. Your local professional chimney sweep, building inspector, or fire department official will be able to inspect the chimney or provide a referral to someone who can.

The chimney must extend at least 3' (914 mm) above the highest point where it passes through or near a roof, and at least 2' (610 mm) higher than any part of a building within 10' (3 m) horizontally. (Figure 2.2)

For proper draft and good performance, any chimney used should extend at least 16' (5 m) above the flue collar of the stove.

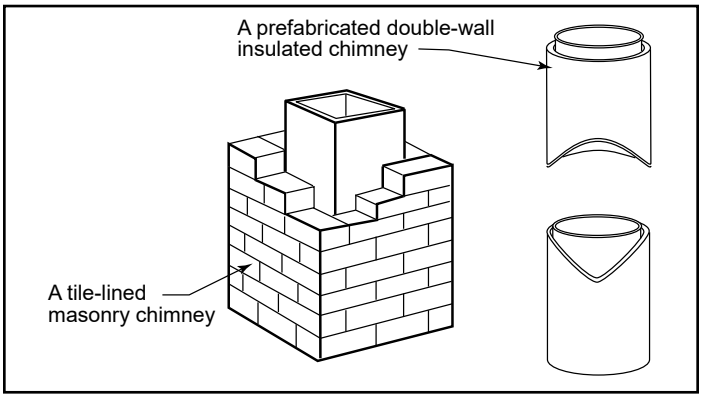


Figure 2.1 - Approved chimney types.

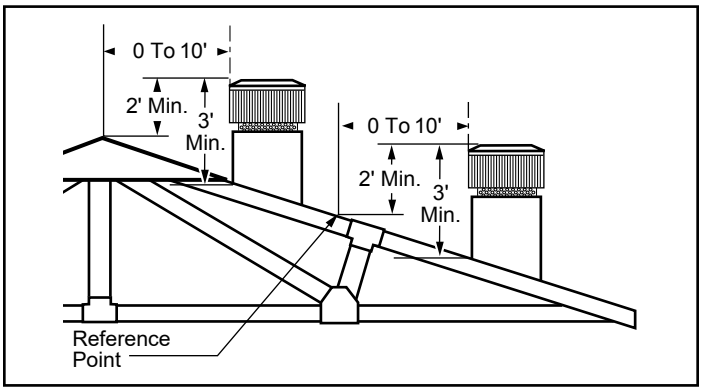


Figure 2.2 - The 2'-3'10' Chimney Rule.

Masonry Chimneys

An inspection of the chimney must confirm that it has a lining. Do not use an unlined chimney. The chimney should have no cracks, loose mortar, other signs of deterioration, and blockage. Repair any defects before the chimney is used with your stove.

Unused openings in an existing masonry chimney must be sealed with masonry to the thickness of the chimney wall, and the chimney liner should be repaired. Openings sealed with pie plates or wallpaper are a hazard and should be sealed with mortar or refractory cement. In the event of a chimney fire, flames and smoke may be forced out of these unused thimbles.

The chimney should be thoroughly cleaned before use.

A newly-built masonry chimney must conform to the standards of your local building code or, in the absence of a local code, to a recognized national code. Masonry chimneys must be lined, either with code-approved masonry or pre-cast refractory tiles, stainless steel pipe, or a code-approved, "poured-in-place" liner. The chimney's clean-out door must seal tightly. A loose or leaky clean-out door can weaken chimney draft, causing performance problems.

Prefabricated Chimneys

A prefabricated metal chimney must be one tested and listed for use with solid-fuel burning appliances to the High-Temperature (H.T.) Chimney Standard UL-103-1985 (2100°F) for the United States, and High Temperature (650°C) Standard ULC S-629 for Canada.

DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE.

C. Chimney Size

This appliance with an 8" (203 mm) flue collar is approved for venting into a masonry chimney with a nominal flue size of 8" x 8" (203 x 203 mm) or 8" x 12" (203 x 305 mm), and into a round flue with nominal flue size of 8" (203 mm). This appliance with a 6" (152 mm) flue connector is approved for venting into a masonry chimney with a nominal flue size of 8" x 8" (203 x 203 mm), and into a round flue with nominal flue of 6" (152 mm).

Whatever the flue collar size, this appliance may be vented into larger chimneys as well. However, chimneys with liners larger than 8" x 12" (203 x 305 mm) may experience rapid cooling of smoke and reduction in draft, especially if the chimneys are located outside the home. These large chimneys may need to be insulated or have their flues relined for proper stove performance.

Accessories to help make the connection between stainless steel chimney liners and your appliance are available through your local dealer.

D. Chimney Connector Guidelines

A chimney connector is the single-wall pipe that connects the stove to the chimney. The chimney itself is the masonry or prefabricated structure that encloses the flue. Chimney connectors are used only to connect the stove to the chimney.

Single-wall connectors should be made of 24 gauge or heavier steel. Do not use galvanized connector; it cannot withstand the high temperatures that can be reached by smoke and exhaust gases, and may release toxic fumes under high heat. The connector may be 6" (152 mm) or 8" (203 mm) in diameter.

If possible, do not pass the chimney connector through a combustible wall or ceiling. If passage through a combustible wall is unavoidable, refer to the section on Wall Pass-Throughs. Do not pass the connector through an attic, a closet or similar concealed space. The whole connector should be exposed and accessible for inspection and cleaning.

In horizontal runs of unshielded chimney connector, maintain a distance of 30" (762 mm) from the ceiling. Keep it as short and direct as possible, with no more than two 90° turns. Slope horizontal runs of connector upward 1/4" per foot (6mm per meter) going from the stove toward the chimney. The recommended maximum length of a horizontal run is 3' (1 m), and the total length should be no longer than 8' (2.4 m). In cathedral ceiling installations, extend the prefabricated chimney downward to within 8' (2.4 m) of the stove. This will help maintain a good draft by keeping the smoke warm, so that it rises readily.

Wear gloves and protective eyewear when drilling, cutting or joining sections of chimney connector.

Single-wall Chimney Connectors

- Begin assembly at the flue collar of the stove. Insert the first crimped end into the stove's flue collar, and keep each crimped end pointing toward the stove, Figure 2.3. Using the holes in the flue collar as guides, drill 1/8" (3 mm) holes in the bottom of the first section of chimney connector and secure it to the flue collar with three #10 x 1/2" sheet metal screws. Lift off the griddle, and shield the stove's surface between the griddle opening and the front of the flue collar to protect the finish when you drill the front hole.

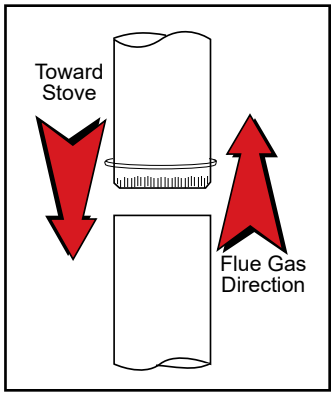


Figure 2.3

- Fasten each joint between sections of chimney connector, including telescoping joints, with at least three (3) sheet metal screws. The pre-drilled holes in the top of each section of chimney connector serve as guides when you drill 1/8" (3 mm) holes in the bottom of the next section.
- Fasten the chimney connector to the chimney. Instructions for various installations follow. Figure 2.4 illustrates the general layout of chimney connector parts.
- Be sure the installed stove and chimney connector are correct distances from nearby combustible materials.

NOTE: Special slip pipes and thimble sleeves that form telescoping joints between sections of chimney connector are available to simplify installations. They often eliminate the need to cut individual connector sections. Consult your local dealer about these special pieces.

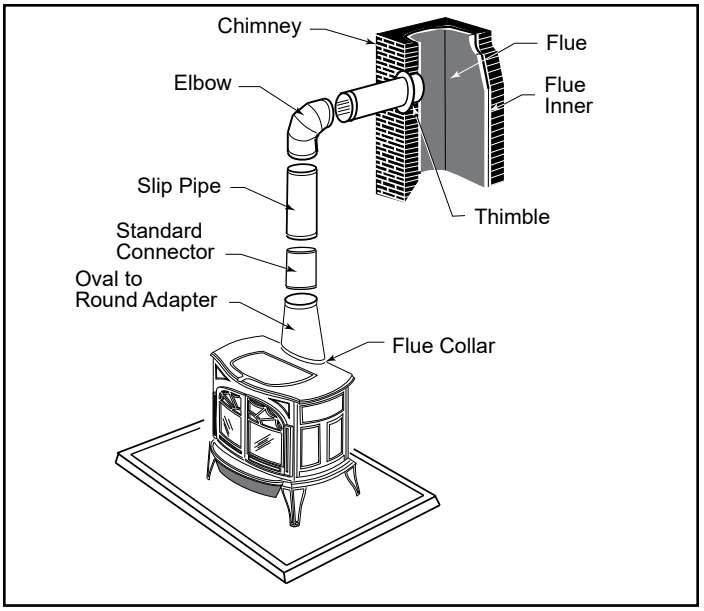


Figure 2.4 - An exploded view of the chimney connection in a freestanding masonry installation.

Securing the Single-wall Connector to a Prefabricated Chimney

Follow the installation instructions of the chimney manufacturer exactly as you install the chimney. The manufacturer of the chimney will supply the accessories to support the chimney, either from the roof of the house, at the ceiling of the room where the stove is installed, or from an exterior wall.

Special adapters are available from your local dealer to make the connection between the prefabricated chimney and the chimney connector. The top of such adapters attaches directly to the chimney or to the chimney's ceiling support package, while the bottom of the adapter is screwed to the chimney connector.

These adapters are designed so the top end will fit outside the inner wall of the chimney, and the bottom end will fit inside the first section of chimney connector.

Securing the Single-wall Connector to a Masonry Chimney

Both freestanding masonry chimneys and fireplace masonry chimneys may be used for your installation.

Freestanding Installations

If the chimney connector must pass through a combustible wall to reach the chimney, follow the recommendations in the Wall Pass-Through section that follows. The opening through the chimney wall to the flue (the "breech") must be lined with either a ceramic or metal cylinder, called the "thimble," which is cemented securely in place. Most chimney breeches incorporate thimbles, but the fit must be snug and the joint between the thimble and the chimney wall must be cemented firmly.

A special piece called the “thimble sleeve,” slightly smaller in diameter than standard connectors and most thimbles, will facilitate the removal of the chimney connector system for inspection and cleaning, Figure 2.5. Thimble sleeves are available from your local dealer.

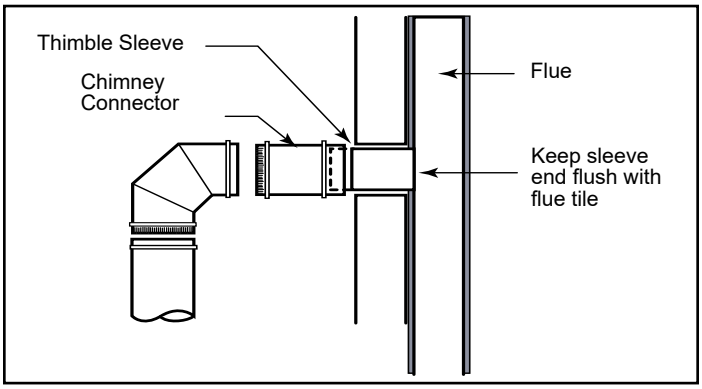


Figure 2.5 - The thimble, made of either ceramic or metal, must be cemented securely in place.

To install a thimble sleeve, slide it into the breech until it is flush with the inner flue wall. Do not extend it into the actual flue passage, as this could interfere with the draft.

The thimble sleeve should protrude 1-2" (25-50 mm) into the room. Use furnace cement and thin gasketing to seal the sleeve in place in the thimble. Secure the chimney connector to the outer end of the sleeve with sheet metal screws.

Without a thimble, a suitable length of chimney connector can be extended through the breech to the inner face of the flue liner, and cemented securely in place. Additional pieces of connector are then attached with sheet metal screws.

E. Fireplace Installations

The chimney connector may be connected to the chimney above the fireplace opening or through the fireplace.

Above the Fireplace

Your appliance may be connected to a chimney above a fireplace opening, Figure 2.6. In such installations, the stove is positioned on the hearth in front of the fireplace and the chimney connector rises from the stove top and then angles ninety degrees back into the chimney. The chimney liner should extend to the point at which the chimney connector enters the chimney.

If the chimney connector in your installation enters the chimney above a fireplace, follow all the guidelines mentioned above for freestanding installations. In addition, give special consideration to the following points:

- Check the clearance between the mantel and the chimney connector, and any combustible trim or the mantel.
- Check the clearance between the chimney connector and the ceiling. the clearance between the connector pipe and the ceiling should be at least 30" (762 mm).

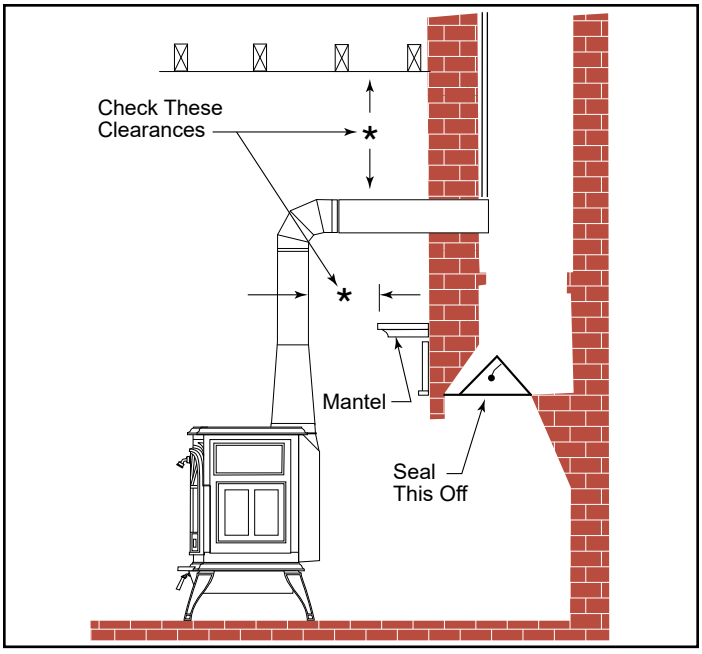


Figure 2.6 - In this installation, the chimney connector attaches to the chimney above the fireplace opening.

- The fireplace damper must be sealed to prevent room air from escaping up the flue. However, it must be possible to re-open the damper to inspect or clean the chimney.

Through the Fireplace

If your fireplace opening height is at least 29" (737 mm), you may install your appliance through the opening using a “positive connection” kit, available from your local dealer. Positive connection kits ensure a tight fit between the stove flue collar and the chimney flue, Figure 2.7.

Fireplace installations, whether connected to the flue above or through the fireplace opening, have special clearance requirements to adjacent trim and the mantel. You’ll find the required safe clearances for fireplace installations on Page 12.

Floor protection requirements also apply to fireplace installations. Refer to the "Floor Protection" section in this manual.

Wall Pass-Throughs

Whenever possible, design your installation so the connector does not pass through a combustible wall. If you are considering a wall pass-through in your installation, check with your building inspector before you begin. Also, check with the chimney connector manufacturer for any specific requirements.

Accessories are available for use as wall pass-throughs. If using one of these, make sure it has been tested and listed for use as a wall pass-through.

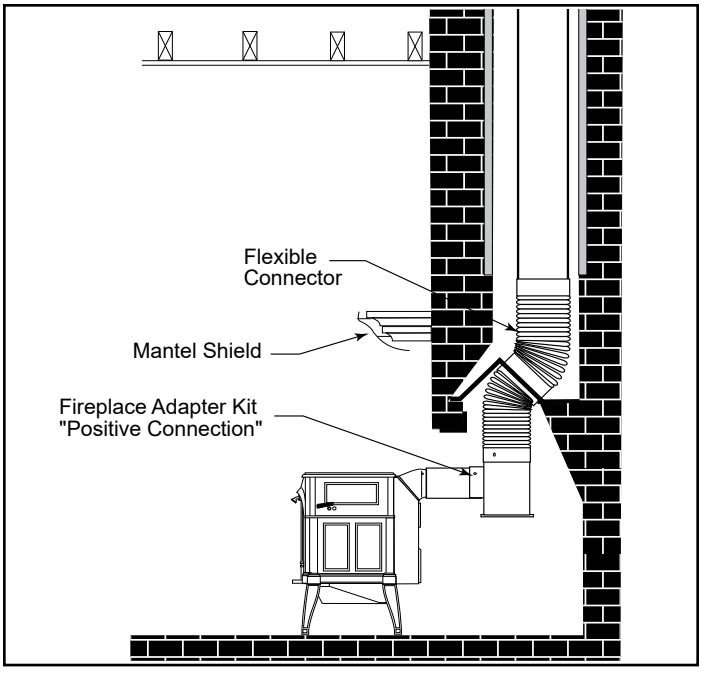


Figure 2.7 - Through the fireplace installation.

In the United States, the National Fire Protection Association (NFPA) has established guidelines for passing chimney connectors through combustible walls. Many building code inspectors follow these guidelines when approving installations.

Figure 2.8 shows one NFPA recommended method. All combustible material in the wall is cut away from the single-wall connector to provide the required 12" (305 mm) clearance. Any material used to close up the opening must be noncombustible.

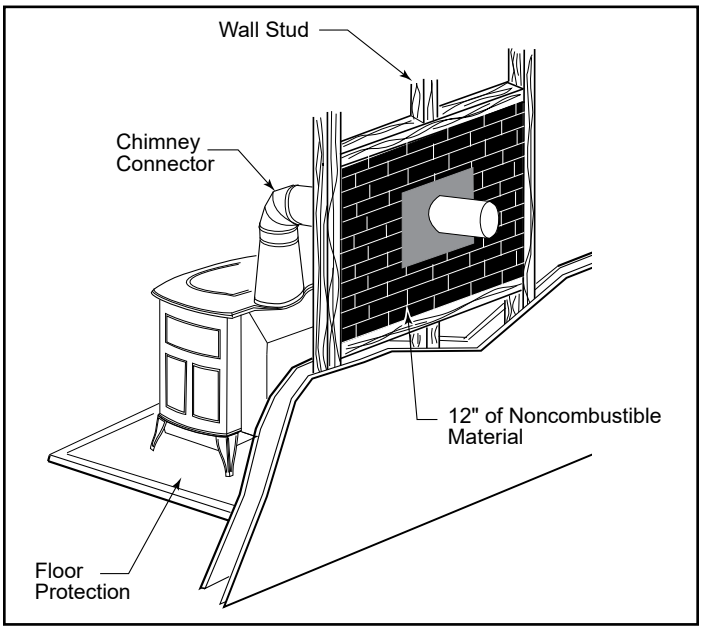


Figure 2.8 - An approved wall pass-through for the United States.

Three other methods are also approved by the NFPA:

- Placing a section of chimney connector inside a ventilated thimble, which in turn is separated from combustibles by 6" (152 mm) of fiberglass insulating material.
- Placing a section of chimney connector inside a section of 9" (230 mm) diameter, solid-insulated, factory-built chimney, with 2" (51 mm) of air space between the chimney section and combustibles.
- Using a section of solid-insulated double-wall high temperature chimney, with an inside diameter the same as the chimney connector, at least one inch of solid insulation, and a minimum of 9" (229 mm) air space between the outer wall of the chimney section and combustibles.

In Canada, The Canadian Standards Association has established different guidelines for wall pass-throughs. Figure 2.9 shows one method, in which all combustible material in the wall is cut away to provide the required 18" (457 mm) clearance for the connector. The resulting space must remain empty. A flush-mounted sheet metal cover may be used on one side only. If covers must be used on both sides, each cover must be mounted on noncombustible spacers at least 1" (25 mm) clear of the wall.

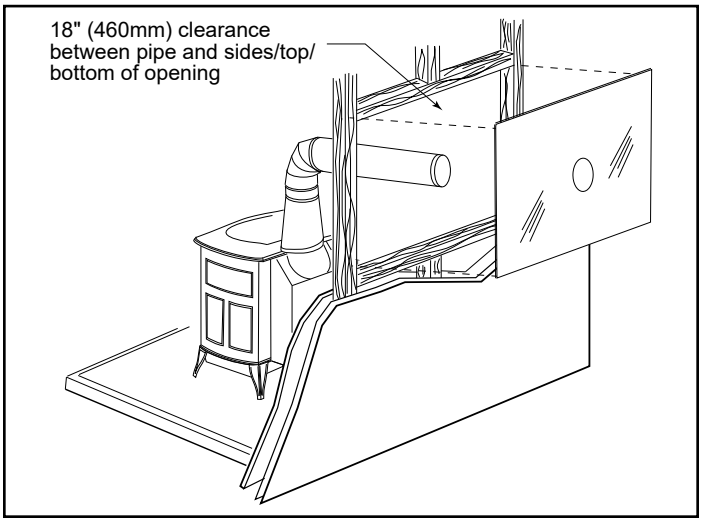


Figure 2.9 - An approved wall pass-through for Canada.

Your local dealer or your local building inspector can provide details for other approved methods of passing a chimney connector through a combustible wall in your area. In Canada, this type of installation must conform to CAN/CSA-B365, Installation Code for Solid Fuel Burning Appliances and Equipment.

NOTE: Do not vent your appliance into a factory-built (zero-clearance) fireplace. These appliances and their chimneys are specifically designed as a unit for use as fireplaces. It may void the listing or be hazardous to adapt them for any other use.

DO NOT CONNECT THIS APPLIANCE TO ANY AIR DISTRIBUTION DUCT OR SYSTEM.

F. Floor Protection

CAUTION

Hearth and Home Technologies does not recommend adhesive based vinyl flooring due to thermal expansion. Floating-style flooring (LVP - luxury vinyl plank or LVT – luxury vinyl tile) can be used, but it will reach temperatures up to 110 °F in a room with ambient temperature of 70 °F. Consult flooring specifications to ensure compatibility.

When using LVP/LVT flooring, HHT recommends wood stove and inserts have 57 inches of alternative flooring in front of the stove or insert before using LVP/LVT. Whether the stove or insert sits flush on the floor or is elevated on a raised hearth, 57 inches of alternative flooring is required in front of the stove or insert.

For all other flooring, continue to follow clearance to combustible requirements in the installation manual.

NOTICE: *Clearances that do not meet the minimum guidelines could result in damage or buckling to the vinyl flooring and is done at the installer's risk.*

A tremendous amount of heat radiates from the bottom plate of your stove. The floor area directly under and around the stove will require protection from radiant heat as well as from stray sparks or embers that may escape the firebox.

Heat protection is provided with the use of the Bottom Heat Shield supplied with the stove.

Most installations will require the bottom heat shield to be attached. Only when the stove is placed on a completely noncombustible surface such as unpainted concrete over earth may it be used without the heat shield.

With the bottom heat shield installed this appliance was tested with spark and ember protection only. There is no required "R" value, and the floor protector only needs to be a non-combustible material, e.g. ceramic tile or sheet metal.

Important: All installations on a combustible floor require the use of the supplied bottom heat shield.

The Defiant does not require R value floor protection.

The minimum floor protector material is 20 gauge sheet metal. Other floor protector materials that can be used include Type I hearth pads, ceramic tile, stone, brick, etc.

Protection requirements vary somewhat between the Untied States and Canada as follows:

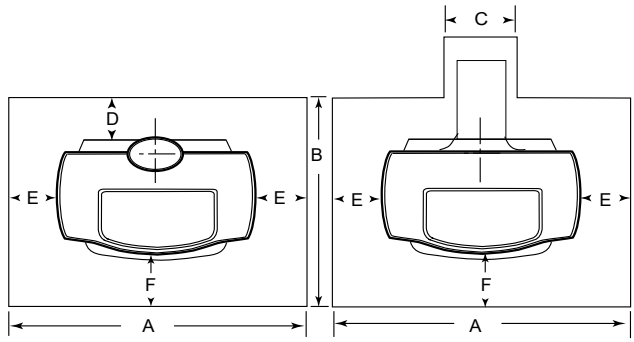
In U. S. installations the floor protector is required under the stove and must extend at least 16" (not including the ash lip) from the front of the stove ("F," Figure 2.10), and at least 6" from the sides and rear. ("D" and "E," Figure 2.10)

In rear venting configurations, floor protection must also extend under the chimney connector and 2" to either side. ("C," Figure 2.10) For the 8" (203 mm) connector, the protector must be a minimum of 12" (305 mm) wide. For the 6" (152 mm) connector, the protector must be 10" (254 mm) wide. The protector must be centered under the connector.

To meet these requirements, a floor protector must be at least 39" wide and 45" deep.

In Canada: A noncombustible floor protector is required under the stove as well. The floor protector must extend 18" (457 mm) to the front ("F," Figure 2.10), and 8" (203 mm) from the sides and rear. ("D" and "E," Figure 2.10)

To meet these requirements, a floor protector must be at least 43" (1092 mm) wide and 49" (1245 mm) deep.



	U.S.	Canada
A	44"	47-1/4" (1200 mm)
B	46"	49-1/8" (1247 mm)
C	12" 10"	12" (305 mm) 8" Connector 10" (250 mm) 6" Connector
D	6"	8" (203 mm)
E	6"	8" (203 mm)
F	16"	18" (460 mm)

Figure 2.10 - Required floor protection dimensions.

G. Clearance to Combustibles

Keep the Stove a Safe Distance From Surrounding Materials

Both a stove and its chimney connector radiate heat in all directions when operating, and nearby combustible materials can overheat dangerously if they are too close to the heat source. A safe installation requires that adequate clearance be maintained between the hot stove and its connector and nearby combustibles.

Clearance is the distance between either your stove or chimney connector, and nearby walls, floors, the ceiling, and any other fixed combustible surface. This appliance has specific clearance requirements that have been established after careful research and testing. These clearance requirements must be strictly observed.

In addition, keep furnishings and other combustible materials away from the stove. In general, a distance of 48" (1219 mm) must be maintained between the stove and movable combustible items such as drying clothes, furniture, newspapers, firewood, etc. Keeping those clearance areas empty assures that nearby surfaces and objects will not overheat.

Safe Ways to Reduce Clearances

Clearance requirements are established to meet every installation possibility, and they involve the combination of these variables:

- When the stove pipe has no listed heat shield mounted on it.
- When the wall has no heat shield mounted on it.
- When the wall has a heat shield mounted on it.
- When the wall and stove pipe have heat shields.

In general, the greatest clearance is required when you place a stove and its connector near a wall with no heat shield.

Clearances may be reduced only by means approved by the regulatory authority, and in accordance with the clearances listed in this manual. Refer to the clearance chart for approved clearance reduction specifications.

NOTE: Installation of this appliance is not permitted in alcoves.

Wall Shields

One way to reduce clearances is with a wall shield constructed of 24 gauge or heavier sheet metal, or of another noncombustible material such as 1/2" (13 mm) insulation board such as Durock® or Wonderboard®, or common brick “laid on flat,” with the 3-1/2" (90 mm) side down.

Shields must be spaced out from the combustible surface 1" (25 mm) on noncombustible spacers, as in Figure 2.11. The spacers should not be directly behind the stove or chimney connector.

Air must be able to flow between the wall and the shield. At least 50% of the bottom 1" (25 mm) of the shield must be open, and the shield must be open at the top. Metal screening across the top will keep small stray objects from being trapped behind the shield, Figure 2.11.

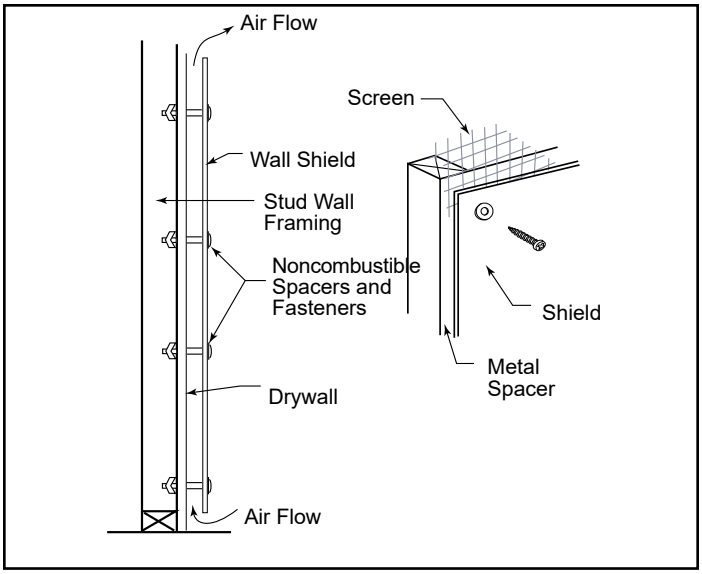


Figure 2.11 - Approved wall shield construction.

The shield must be a minimum of 48" (1219 mm) tall, and must extend at least 19" (483 mm) higher than the top of the stove, whichever is higher. The shield behind the chimney connector must be 30" (760 mm) wide, centered behind the pipe; for installations that use an approved prefabricated chimney to pass through the ceiling, the shield behind the chimney connector must stop 1" (25 mm) below the ceiling.

With 8" connections and chimneys, because of potentially higher pipe temperatures, the shield must extend the full height of the wall (up to 9’ (2.7 m)) and stop 1" (25 mm) below the ceiling.

Fireplace and Mantel Trim Shields

A fireplace installation requires special clearance between the side of the stove and the right and left walls, between the side of the stove and the decorative side trim on the fireplace face, and between the top of the stove and the mantel.

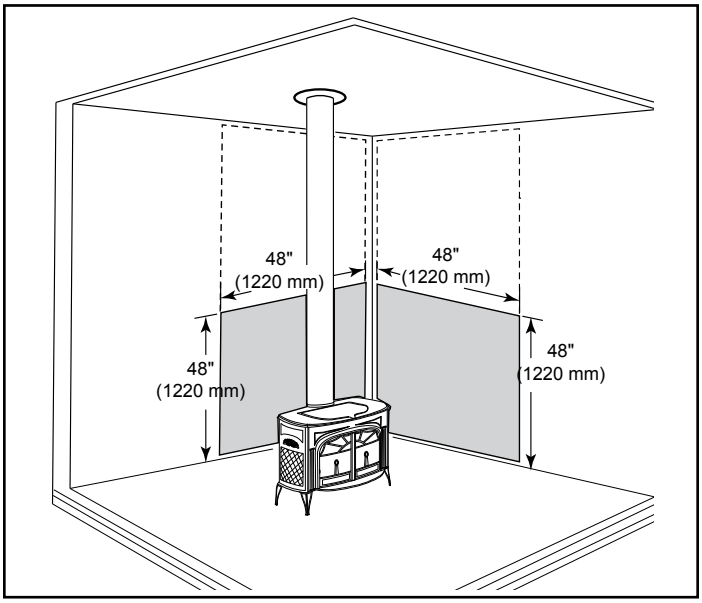


Figure 2.14 - Parallel installation, vertical chimney connector, two wall shields. Reduced clearances for both rear and side walls. Wall shields may meet at corner if desired. Shielding for connector is centered behind connector.

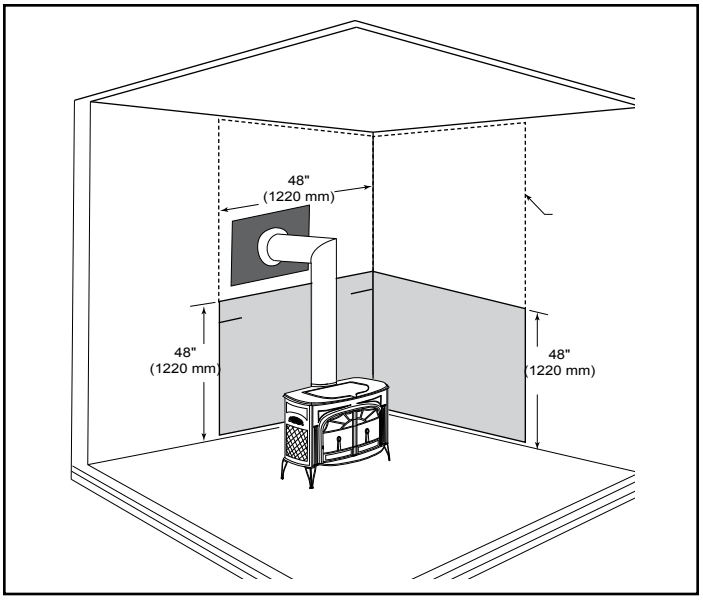


Figure 2.15 - Parallel installation with rear wall pass-through, two wall shields. Reduced clearances to both rear and side walls. Wall shields may meet at corner if desired. Wall pass-through must comply with codes.

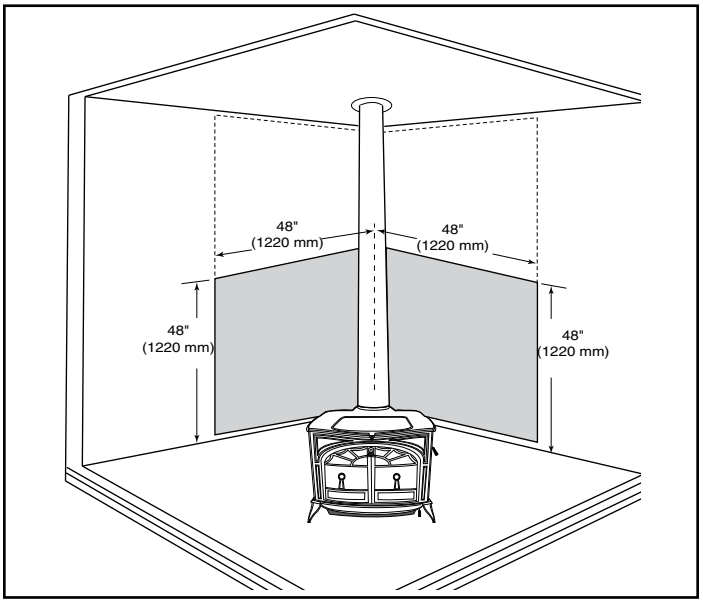


Figure 2.16 - Corner installation, vertical chimney connector, two wall shields. Reduced side clearances. Wall shield MUST meet at corner.

Noncombustible shields installed 1" (25 mm) away from the combustible surface on noncombustible spacers, called ventilated shields, may be used to reduce clearances.

To protect a mantel from the heat of a stove in a fireplace installation, use a custom-made ventilated mantel shield that is at least 48" (1220 mm) long, centered over the stove. (Figure 13) Ventilated shields for side trim must extend the full length of the trim.

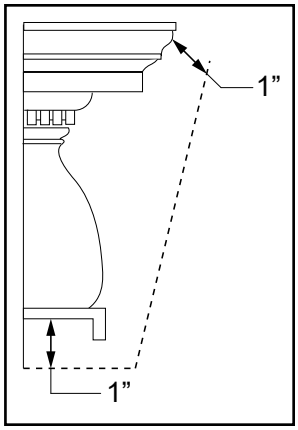


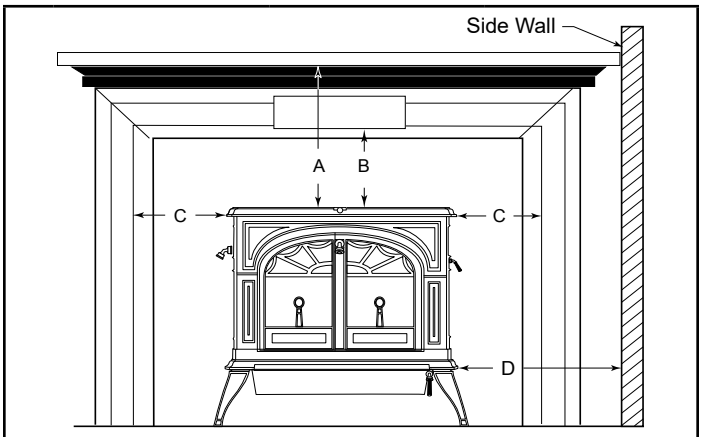
Figure 2.12 - A custom-formed mantel shield.

An unprotected mantel ("A", Figure 2.13) cannot be more than 9" (230 mm) deep and must have a minimum clearance of 41" (1041 mm), measured from the stove's top plate. With a ventilated shield, this clearance may be reduced safely to 29" (737 mm).

Unprotected top trim (B) protruding 3/4" (19 mm) or less from the face of the fireplace must be a minimum of 28" (711 mm) from the stove's top surface. With a ventilated trim shield, this clearance may be reduced safely to 21" (533 mm).

Unprotected side trim (C) that protrudes 3/4" (19 mm) or less Side Wall from the face of a fireplace must have a minimum clearance of 14" (356 mm), measured from the stove's top side edge. If the trim extends more than 3/4" (19 mm), it is subject to the requirements for wall clearance.

The charts and sample installations that follow list all the clearances required for the various installation configurations of this appliance.



Fireplace and Mantel Trim Clearances			
		Unprotected	**NFPA 211 Protected**
A	Mantel Trim	41" (1041 mm)	29" (737 mm)
B	Top Trim	28" (711 mm)	21" (533 mm)
C	Side Trim	14" (356 mm)	14" (356 mm)
D	Side Wall	21" (533 mm)	11" (280mm)

Figure 2.13 - Maintain clearances to combustible components of the mantel piece.

For use with either 6” or 8” flue collar/chimney connection

	Stove Clearance							
	Unprotected Surface No Connector Heat Shield				Protected Surfaces[1] with Connector Heat Shield			
	Stove Installed Parallel to Wall			Stove in Corner	Stove Installed Parallel to Wall			Stove in Corner
	Side	Rear		Corners	Side	Rear		Corners
		(to rear shroud)	(to back edge of cast)			(to rear shroud)	(to back edge of cast)	
Top exit with single wall connector pipe	(A) 21" (521 mm)	(B) 15" (381 mm)	(C) 21" (521 mm)	(D) 5" (127 mm)	(E) 5" (127 mm	(F) 3" (76 mm)	(G) 9" (229 mm)	(D) 5" (127 mm)
Top Exit with Double wall[2] connector pipe	(H) 21" (521 mm)	(I) 15" (381 mm)	(J) 21" (521 mm)	(K) 5" (127 mm)	(L) 5" (127 mm)	(M) 3" (76 mm)	(N) 9" (229 mm)	(O) 2" (51 mm)
Rear Exit	(P) 21" (521 mm)	(Q) 10" (254 mm)	(R) 16" (407 mm)	N/A	N/A	N/A	N/A	N/A

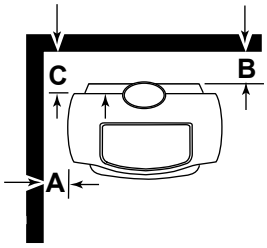
The attached rear shroud must be used in all installations. The flue collar heat shield must be used in all vertical installations.

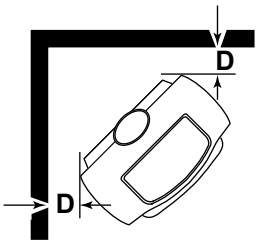
1. The connector pipe heat shield must extend 36" (914 mm) above the flue collar.
2. Using a listed double wall oval to round connector.
3. A minimum of 67” (170 cm) from the top of the stove to the ceiling is required for all installations of the Defiant®.

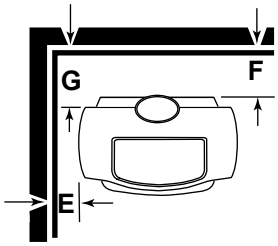
For use with either 6" or 8" flue collar/chimney connector

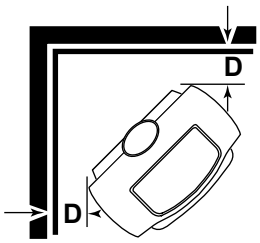
Unprotected Surfaces		Protected Surfaces	
Stove Installed Parallel to Wall	**Stove in Corner**	**Stove Installed Parallel to Wall**	**Stove Installed Parallel to Wall**

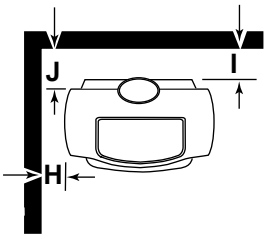
Top Exit Installations, single-wall connector

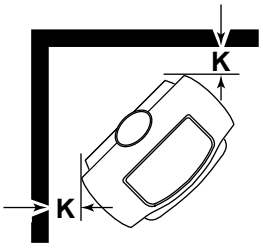


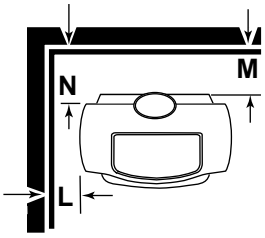


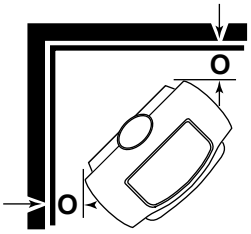




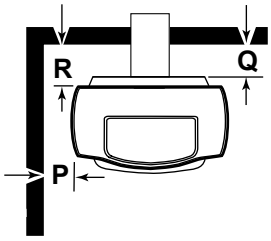


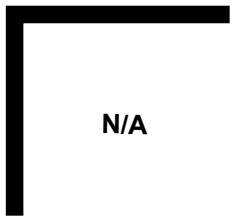


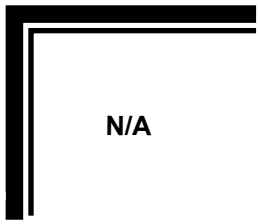


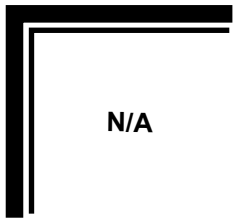


Top Exit Installations, double-wall chimney connector, flue collar shield installed









Rear Exit Installations

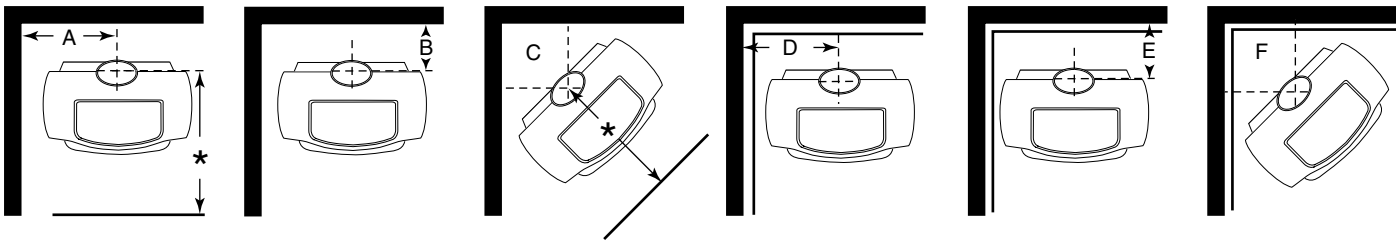
Distance from the Center of the Flue Collar to the Wall in Top-Exit Installations

The information on this page is helpful in planning stove placement for top-exiting installations, particularly those installations with chimneys that pass through the ceiling. However, this is not a clearance chart. Final stove clearances must adhere to the guidelines stated in the clearance chart on Page 14.

Dimensions indicated are valid for installations with either 6" or 8" flue collars.

Single Wall - No Connector Heat Shields					
Unprotected Surface			Protected Surface		
Parallel Installations		Corner Installations	Parallel Installations		Corner Installations
Side (A)	Rear (B)	Corner (C)	Side (D)	Rear (E)	Corner (F)
36-1/2" (927 mm)	21" (533 mm)	16" (406 mm)	20-1/2" (521 mm)	9" (229 mm)	16" (406 mm)

Double Wall Connector					
Side (A)	Rear (B)	Corner (C)	Side (D)	Rear (E)	Corner (F)
36-1/2" (927 mm)	21" (533 mm)	16" (406 mm)	20-1/2" (521 mm)	9" (229 mm)	16" (406 mm)



* This distance, from the center of the flue collar to the front edge of the hearth, is the same for all installations on this page: 34" (865 mm) in the United States and 36" (914 mm) in Canada.

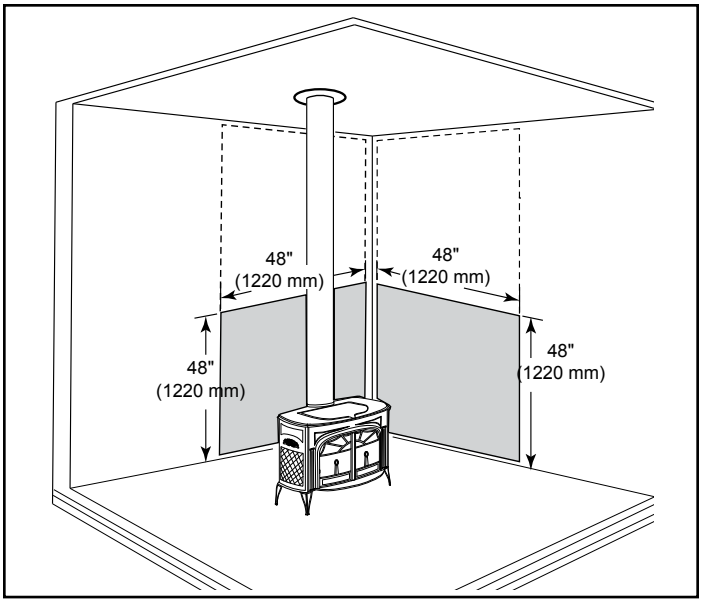


Figure 2.14 - Parallel installation, vertical chimney connector, two wall shields. Reduced clearances for both rear and side walls. Wall shields may meet at corner if desired. Shielding for connector is centered behind connector.

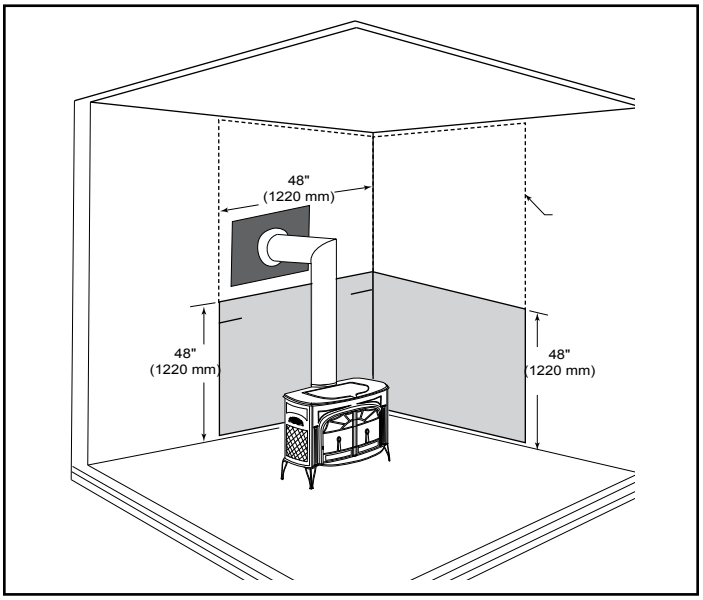


Figure 2.15 - Parallel installation with rear wall pass-through, two wall shields. Reduced clearances to both rear and side walls. Wall shields may meet at corner if desired. Wall pass-through must comply with codes.

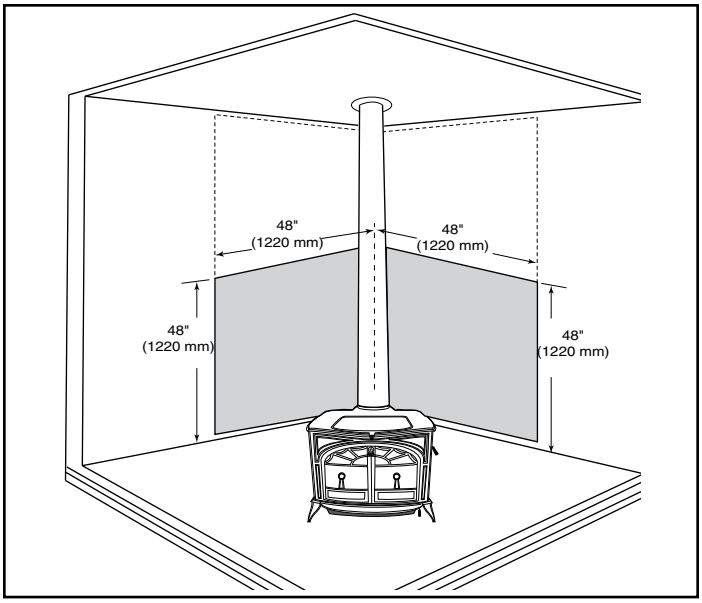


Figure 2.16 - Corner installation, vertical chimney connector, two wall shields. Reduced side clearances. Wall shield MUST meet at corner.

H. Install Checklist

ATTENTION INSTALLER:
Follow this Standard Work Checklist

This standard work checklist is to be used by the installer in conjunction with, not instead of, the instructions contained in this installation manual

Customer: _____

Date Installed: _____

Lot/Address: _____

Location of Appliance: _____

Installer: _____

Dealer/ Distributor Phone #: _____

Serial #: _____

Model : _____

WARNING! Risk of Fire or Explosion! *Failure to install appliance according to these instructions can lead to a fire or explosion.*

Appliance Install	**YES**	**IF NO, WHY?**
Verified clearance to combustibles.		
Appliance is leveled and connector is secured to appliance.		
Hearth extension size/height decided.		
Outside Air Installed.		
Floor protection requirements have been met.		
If appliance is connected to a masonry chimney, it should be cleaned and inspected by a professional. If installed to a factory built metal chimney, the chimney must be installed according to the manufacturer's instructions and clearances.		
Chimney		
Chimney configuration complies with diagrams.		
Chimney installed, locked and secured in place with proper clearance.		
Chimney meets recommended height requirements (Minimum 16 Feet).		
Roof flashing installed and sealed.		
Terminations installed and sealed.		
Clearances		
Combustible materials not installed on non-combustible areas.		
Verified all clearances meet installation manual requirements.		
Mantels and wall projections comply with installation manual requirements.		
Protective hearth strips and hearth extensions installed per manual requirements.		
Appliance Setup		
All packaging and protective materials removed.		
Firebrick/Refractory, baffle and ceramic blanket (if applicable) installed correctly		
All labels have been removed from the door.		
All packaging materials are removed from inside/under the appliance.		
Manual bag and all of its contents are removed from inside/under the appliance and given to the party responsible for use and operation.		

Hearth & Home Technologies recommends the following:

- Photographing the installation and copying this checklist for your file.
- That this checklist remain visible at all times on the appliance until the installation is complete.

Comments: Further description of the issues, who is responsible (Installer/Builder/Other Trades, etc.) and corrective action needed:

Comments communicated to party responsible _____ by _____ on _____
(Builder/Gen. Contractor) (Installer) (Date)

3 Assembly

A. Setting up your Stove

Remove the unit from the shipping brackets by removing (2) 1/4-20 hex head bolts from each shipping bracket, leaving brackets attached to the skid, Figure 3.1. (Save the 1/4-20 hex head bolts as they will be needed later to install heat shield.)

NOTE: When moving the stove, lift the stove to take weight off the legs whenever possible. Dragging or sliding the stove, especially across rough surfaces can cause the legs to loosen or even break.

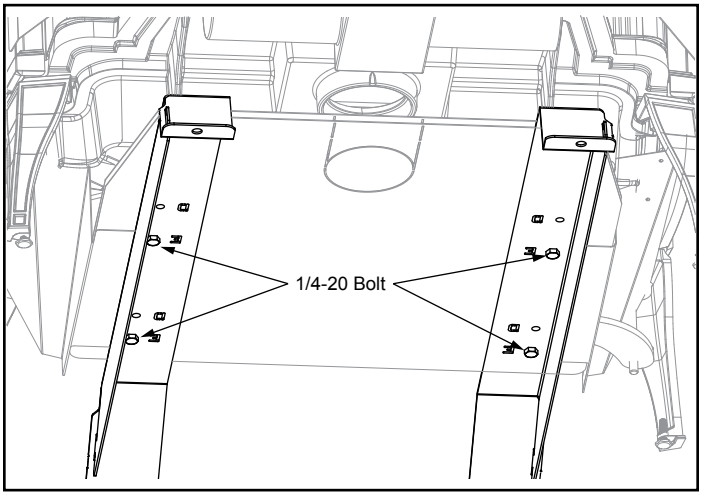


Figure 3.1 - Remove unit from shipping brackets.

Wipe the protective coating of oil from the griddle with a clean dry rag or a paper towel.

Install the handle on the griddle. First, place the griddle upside down at the edge of a flat surface and assemble the handle, Figure 3.2.

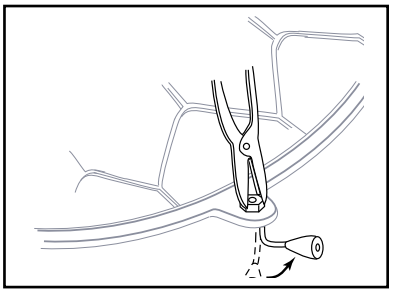


Figure 3.2 - Attach the griddle handle.

With the handle pointing 45° from its final position, tighten the nut as far as possible with the pliers. Move the handle to its final position while still holding the nut with the pliers.

⚠ CAUTION

Overtightening can strip tapped threads.

Storing the Handle

Use the removable handle to open or close the doors. After using it, remove the handle so it will not get hot. Store the handle in the handle holder installed behind the right front leg, Figure 3.3.

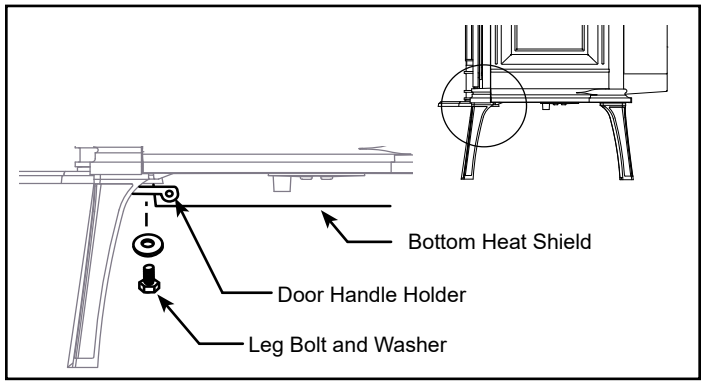


Figure 3.3 - Handle holder and heat shield positions.

B. Install the Bottom Heat Shield

NOTE: The Bottom Heat Shield is required in most installations. Refer to Floor Protection, Section 2F, for further details.

1. Install (4) 1/4-20 x 3/8" hex bolts supplied in the manual bag into the four holes located under the stove, Figure 3.4.
2. Align the bottom heat shield key holes to the four hex bolts previously installed into base, Figure 3.4. The outside air cutout hole should be toward the rear of the stove.
3. Attach the heat shield sides by passing the slots over the bolt heads. Tighten the hex head bolts, Figure 3.4.

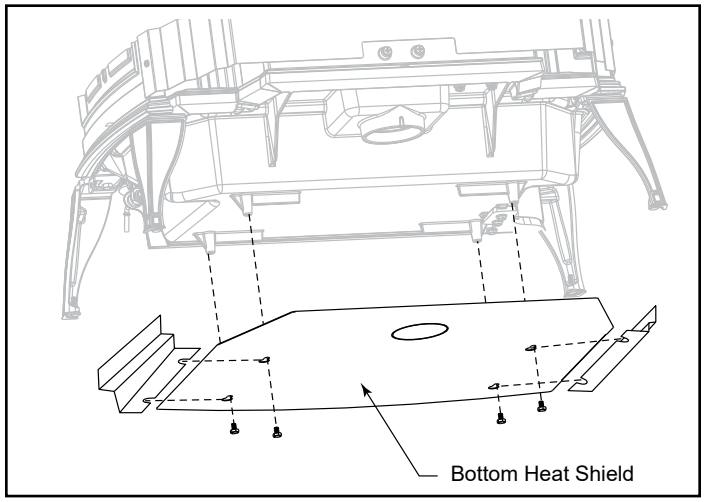


Figure 3.4 - Attach the bottom heat shield.

C. Adjust the Leg Levelers

Lift the stove slightly so there is no weight on the leg while making the adjustment.

D. Reverse Flue Collar (If necessary)

Reverse the flue collar by removing the two screws that attach it to the back of the stove. Be sure the gasket around the flue collar opening is in position when you screw the collar back onto the stove.

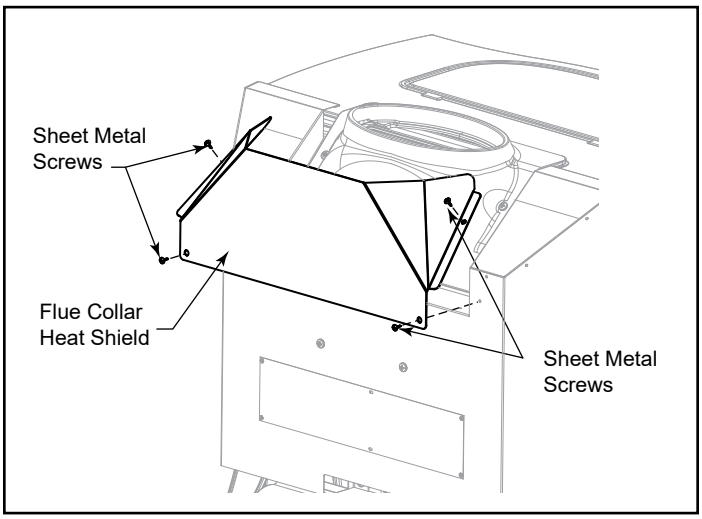


Figure 3.5 - Install flue collar heat shield.

⚠ WARNING

The flue collar heat shield must be installed in all vertical installations. The flue collar heat shield is not used when the flue collar is in the rear exit position.

E. Attach Catalyst Bypass Damper Handle

Use the 1/4"-20 x 3" screw to attach the catalyst bypass damper handle to the catalyst bypass damper stub on the left side.

F. Install Catalyst Temperature Probe

To install the catalyst temperature probe, remove the hole plug from the cast iron wall behind the rear shield, Figure 3.6. Use two #10 sheet metal screws and bracket supplied, secure the bracket and probe to the back of your stove, Figure 3.6.

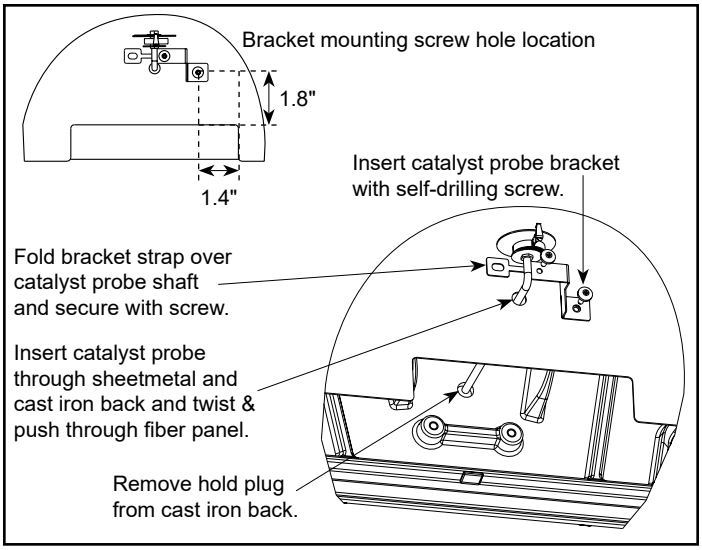


Figure 3.6 - Install the Catalyst Temperature Probe

G. Attach Primary Air Thermostat Handle

The primary air thermostat handle is the smaller of the two black handles. Secure the handle to the stub on the right side of the stove with an 8-32 x 2" slot head machine screw, Figure 3.7.

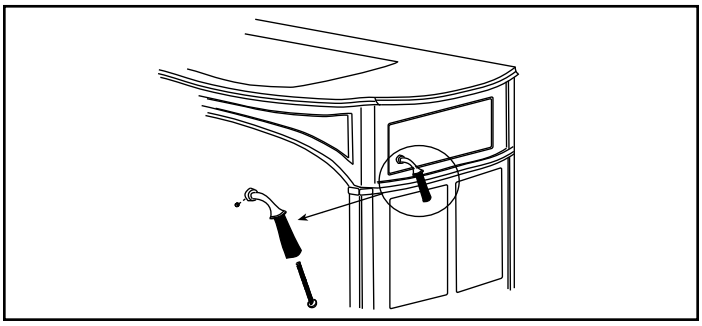


Figure 3.7 - Attach the thermostat handle.

H. Assemble the Removable Insert Handle

The wooden removable insert handle opens and closes the front doors. Remove after each use, and store it in the handle holder behind the right front leg. Assemble the handle by passing the 3-3/8" screw through the wooden shaft and into the bright metal nub, Figure 3.8. Tighten carefully until snug.

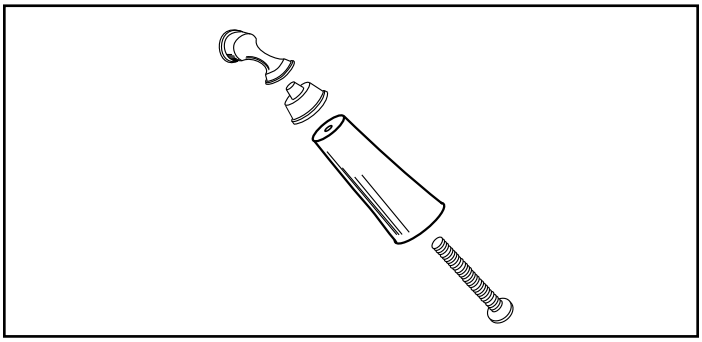


Figure 3.8 - Assemble the front door handle.

I. Fan Kit Installation

1. Attach the fan assembly at the bottom edge of the inner back with two (2) 1/4-20 x 3/4" hex head screws.
2. Attach snapstat to the mounting holes on the underside of the bottom with two (2) 1/4-20 pan head screws.
3. Attach the rheostat holder under the right front wing of the bottom heat shield with two (2) #10 sheet metal screws.
4. Attach the rheostat to its holder by inserting the rheostat control shaft through the holder hole. Install the retaining ring and rheostat knob onto the shaft.
5. Secure the rheostat cable to the underside of the bottom heat shield using the wire tie provided and the hole at the right rear edge of the heat shield.
6. Fan will not operate until stove reaches approximately 109°F.
7. Plug blower cord into a grounded outlet. Do not remove ground prong from plug. Route power cord to avoid heat from the stove or other damage. Do not route cord under or in front of appliance.

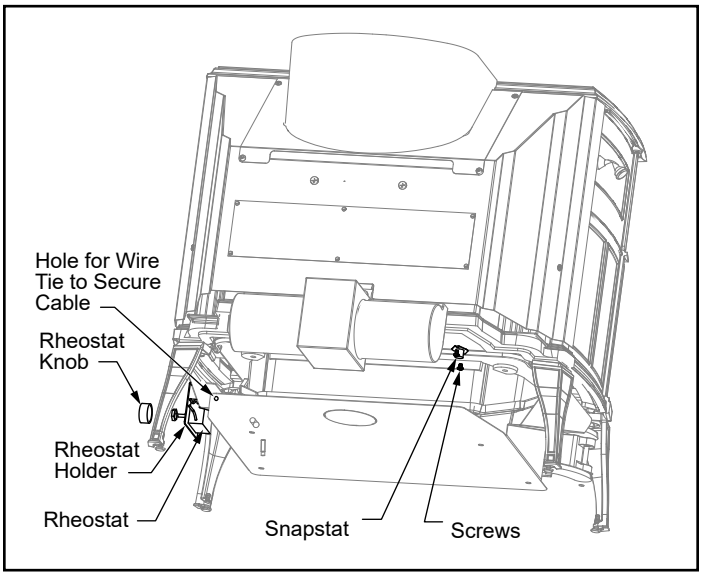


Figure 3.9 - Fan installation

J. Installing/Removing Catalyst

1. Remove the access cover by gently lifting up and pulling out from the bottom edge, Figure 3.10.
2. Remove the inner cover by pulling it straight out, Figure 3.11.
3. Remove the catalyst by gently pulling it straight out, Figure 3.12 Place the catalyst where the catalyst's ceramic components will not be damaged.

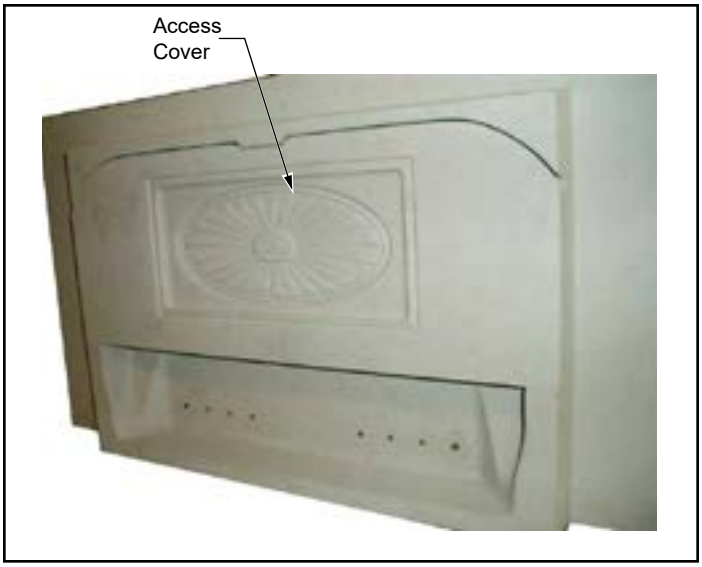


Figure 3.10 - Remove access cover.

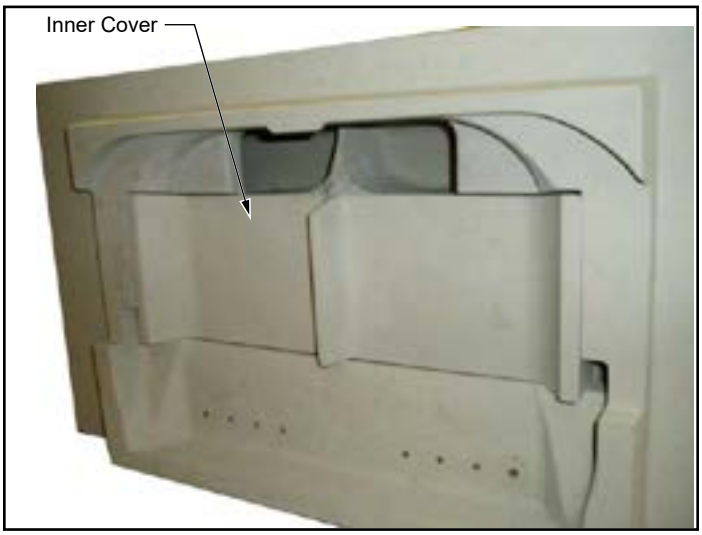


Figure 3.11 - Remove inner cover.

Figure 3.12 - Remove catalyst.

4 Smoke Alarm / Safety Tips

A. Smoke and CO Detectors

The use of smoke and carbon monoxide (CO) detectors throughout the home is strongly advised, even if not required by building codes or insurance regulations. It is a good idea to install a smoke detector in the living areas and each bedroom. Follow the smoke/CO detector manufactures placement and installation instructions and maintain regularly.

You may not, however, wish to install a detector in the immediate vicinity of the stove. Depending on the sensitivity of the unit, the alarm can be set off while you are tending the fire or emptying the ashes. If you install a detector in the same room, locate it as far away from the stove as possible.

B. Safety Tips

Conveniently locate a "Class A" fire extinguisher to contend with small fires. Be sure the fire extinguisher works and is clearly visible. All occupants of the house should know where it is, and how it operates. Have heavy stove gloves available near the stove. Have special safety accessories (e.g., Child Guard Screen) available for use if small children will be in the home.

In the event of a stove pipe or chimney fire….

- Evacuate the house immediately
- Notify the fire department
- If the fire isn't too threatening, closing down the stove tight, (catalyst bypass damper, primary air, all doors) will help to smother the fire.
- Inspect your stove, stove pipe and chimney for any damage caused by the fire and correct any damage before using your stove again.

5 Operation

The Defiant® Model 1975-CAT-C Controls
Two controls regulate the performance of your appliance: a **primary air control** supplies oxygen for the fire, and a **catalyst bypass damper** directs air flow within the stove to activate and deactivate the combustion system, Figure 5.1.

Symbols cast into the stove are reminders of the correct directions for using the controls. The words 'Left' and 'right' in these directions are *facing the stove*.

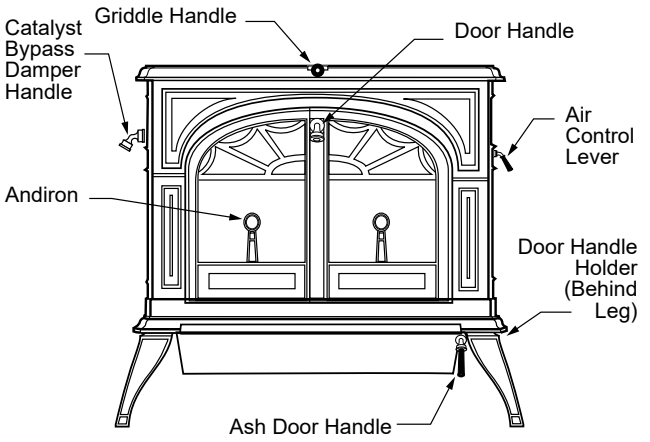


Figure 5.1 - The controls are conveniently located and easy to operate.

A. Primary Air Control

The **primary air control lever**, on the right side of the stove, controls the amount of incoming air for starting, maintaining, and reviving a fire.

Once the air control is manually set, a bi-metallic thermostat automatically maintains the heat output at a constant level for a more even heat over the life of the burn.

More air entering the stove makes the fire burn hotter and faster, while less air prolongs the burn at a lower heat output level, Figure 5.2.

For the greatest air supply and maximum heat output (but the shortest burn time), move the lever toward the front of the stove. For a fire that will last longer with less heat, move the lever toward the rear of the stove.

⚠ WARNING

This wood heater has a manufactured-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.

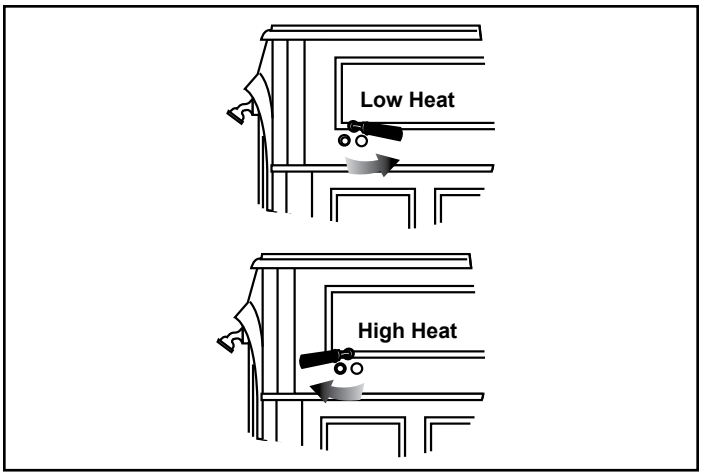


Figure 5.2 - The handle may be positioned anywhere between the two extremes for different heat levels.

B. Catalyst Bypass Damper Adjustment

The **catalyst bypass damper handle** on the left side of the stove operates the catalyst bypass damper to direct air flow within the stove.

The catalyst bypass damper is **open** when the handle points to the **rear**, enabling smoke to pass directly into the chimney. The catalyst bypass damper must be open when starting or reviving a fire, and whenever the griddle or doors are opened.

The catalyst bypass damper is **closed** when the handle points **forward.** Smoke travels through the secondary combustion system where it can be further burned, before passing up the chimney, Figure 5.3.

The catalyst bypass damper should always be either fully open or fully closed. There are no intermediate positions. When closing the catalyst bypass damper, be sure to pull firmly enough to snap the handle into the locked position.

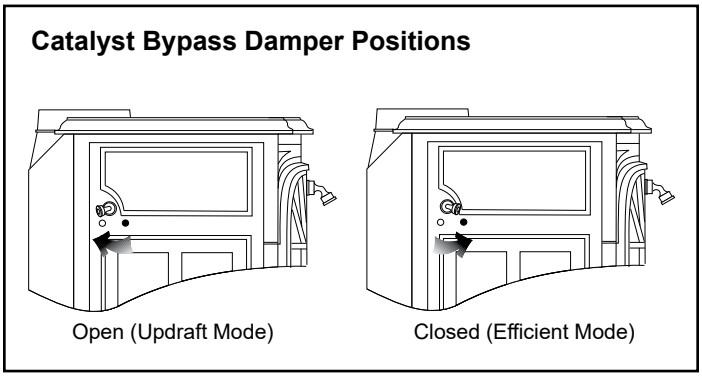


Figure 5.3 - The catalyst bypass damper is either open or closed. There are no intermediate positions.

C. Conditioning Your Stove

Cast iron is extremely strong, but it can be broken with a sharp blow from a hammer or from the thermal shock of rapid and extreme temperature change.

The cast plates expand and contract with changes in temperature. When you first begin using your appliance, minimize thermal stress by letting the plates adjust gradually during three or four initial break-in fires following Steps 1-3 below.

D. Wood Burning Operation

Burn only solid wood in this appliance, and burn it directly on the grate. Do not elevate the fuel. Do not burn coal or other fuels. In the United States, it is against the law to operate this wood heater in a manner inconsistent with operating instructions in this manual.

The catalyst bypass damper must be open when starting a fire or when refueling.

Do not use chemicals or fluids to start the fire. Do not burn garbage. Never use flammable fluids such as gasoline, gasoline type lantern fuel, kerosene, charcoal lighter fluid, naptha, engine oil or similar liquids to start or "freshen up" a fire in this heater. Keep all such liquids well away from the heater while it is in use.

1. Open the stove catalyst bypass damper, and open the primary air control fully.
2. Place several sheets of crumpled newspaper in the stove. Place six or eight pieces of dry kindling split to a finger-width size on the paper. On the kindling, lay two or three larger sticks of split dry wood approximately 1-2" (25-51 mm) in diameter, Figure 5.4.

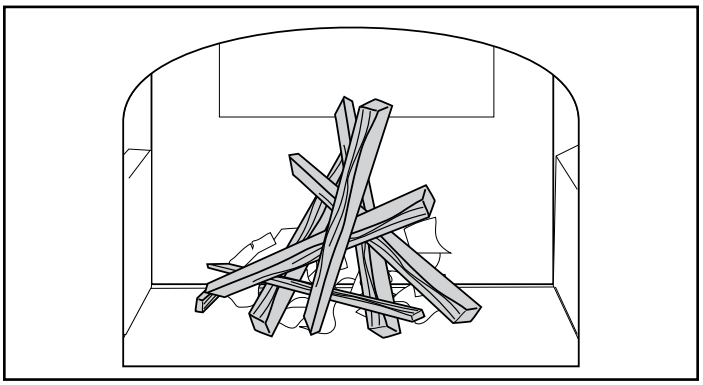


Figure 5.4 - Start the fire with newspaper and dry kindling.

3. Light the newspaper and close the door. Gradually build up the fire by adding a few 3-5" (80-120 mm) diameter pieces of split firewood. **If this is one of the first few "break-in" fires, let the fire burn brightly, and then let it die out.** During the break-in fires, do not let the stove get hotter than 500°F. (260°C) as measured on an optional stove-top thermometer. Adjust the air control lever as necessary to control the fire. Some odor from the stove's hot metal and the paint is normal for the first few fires.

NOTE: Some chimneys must be "primed," or warmed up, before they will draw sufficiently to start a fire. To correct this situation, roll up a couple pieces of newspaper, place them on top of the kindling and toward the back of the stove, light them, and close the doors. This will encourage the smoke to rise rapidly, making it easier to establish a good draft. Once the draft is established, open the front door and light the rest of the fuel from the bottom. Do not light the main bed of fuel until the chimney begins drawing, and repeat the procedure as often as necessary if the initial attempt is unsuccessful.

NOTE: Effectiveness of a "top-down" method to start a fire. Smoke emissions when starting a fire can be difficult to control because the stove is not yet heated to its optimum temperature. One method of reducing emissions during a cold start-up is the use of a "top-down" kindling procedure. In this, place larger pieces of kindling on the bottom of the kindling pile followed by smaller and smaller pieces as the pile is added to. Very finely split pieces should be on the top. Light the kindling pile with a match at the top and allow the kindling to burn downward into the larger pieces. This reduces smoke by slowly increasing the fire size without creating an air-starved condition.

4. **If your appliance has been broken-in previously** using Steps 1-3, continue to build the fire gradually. Add larger wood with a diameter of 3-4" (75-100 mm). Continue adding split logs of this size to the briskly-burning fire until there is a glowing ember bed 2-3" (51-75 mm) deep. (Figure 38) A good ember bed is necessary for proper functioning of the combustion system.
5. Close the catalyst bypass damper when the griddle temperature reaches 450°F (230°C) and sufficient ember bed is established. This will force the smoke into the secondary combustion chamber where the smoke and gases will ignite if the stove is sufficiently hot. Even though it is possible for the fire to get quite hot within a few minutes after a fire is started, secondary combustion may stop or the fire may go out if the fire dies down immediately as a result of the catalyst bypass damper being closed too early.
6. Adjust the air control for your desired heat output.

NOTE: Stove installations vary widely, and the operating guidance given here is only a starting point. The *"Draft Management"* section in this manual will explain in detail how the features of your installation may help or hinder good draft, and how you may need to vary your firing technique if your installation doesn't encourage a good draft.

High-Efficiency Wood Burning with the Catalytic Combustor
Your Defiant stove was shipped from the factory with a separately packaged catalytic combustor.

The catalytic combustor creates optimum conditions for secondary combustion. Refer back to the *"Installing or Removing Catalyst"* section of this manual.

The catalytic element is a ceramic “honeycomb” coated with the catalytic material. The element sits at the bottom of the secondary combustion chamber. Smoke, gases and particulates that are not fully combusted during the secondary combustion process pass through the catalyst, creating a tertiary burn. This results in higher efficiency and lower emissions.

The catalyst will initiate combustion of smoke and particulates at 500° - 600°F (260° - 315°C), half the temperature normally required for unaided secondary combustion. If you followed the startup operation steps in the previous section the stove will be sufficiently hot to allow the combustor to work. Once the combustor starts working, heat generated by burning the smoke will keep it working.

To determine whether the combustor is operating, refer to the temperature probe which shows the operating range of the catalytic combustor. This is located on the back of the stove and is viewed from the top. **NOTE:** It will take several minutes after closing the catalyst bypass damper for the temperature probe to fully adjust to the new temperature. If the probe indicator is below the operate catalyst range, add fuel or open the catalyst bypass damper to allow the fire to further build before engaging the catalyst again.

If the probe indicator is above the operate catalyst range, the catalytic combustor is running too hot and may be damaged. In many cases, decreasing the primary air can reduce the catalyst temperature and adding less wood with each loading can also help if overheating is persistent. Do not add wood to the stove if the probe reads above the operate catalyst range.

Avoid using a full load of very dry wood in the firebox, such as dry slab wood or wood with below 14% moisture content. This may result in continuous very high temperatures in the secondary combustion area and damage the combustor.

Never kindle a fire with colored paper or paper that has colored ink or a glossy surface. Never burn treated wood, garbage, solvents or trash. All of these may poison the catalyst and prevent it from operating properly. Never burn cardboard or loose paper except for kindling purposes. Never burn coal; doing so can produce soot or large flakes of char or fly ash that can coat the combustor and cause smoke to spill into the room. Coal smoke can also poison the catalyst so that it won’t operate properly.

NOTE: The ceramic catalytic combustor is fragile and will crack if subjected to thermal shock. Thermal shock can occur when refueling with wet wood or closing the catalyst bypass damper too early after refueling. Hairline cracks will not affect the performance of the combustor, but repeated thermal shocks can result in cells falling out, somewhat reducing the effectiveness of the combustor.

E. Adding Fuel

The griddle lifts for convenient top-loading of logs, and is the easiest way to add fuel, Figure 5.5.

However, the front doors open as well for adding an occasional log to a fire.

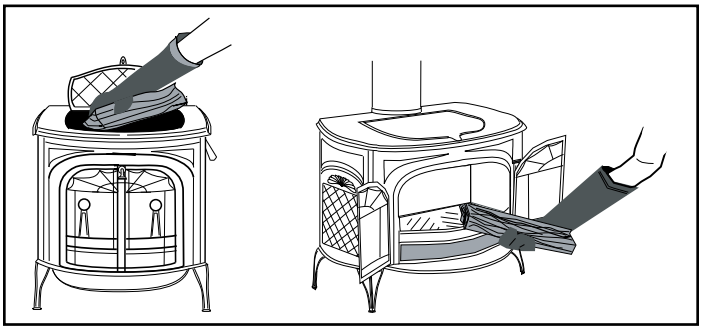


Figure 5.5 - Top loading is the best way to add fuel during regular use. Front loading is useful for kindling a fire.

To open the front doors, insert the handle into the door latch stub and turn it to the left and up, Figure 5.6.

To close them, always close the left door first. Turn the handle in the right door to the left and up (to the open position) and close it. Finally, push on the door as you turn the handle to the right and down. The doors will draw in slightly, and the handle should offer some resistance as you turn it to the closed position.

To reduce the risk of breaking the glass, avoid striking the glass or slamming the doors.

When you are not using the door handle, store it in the holder behind the right front leg of the stove.

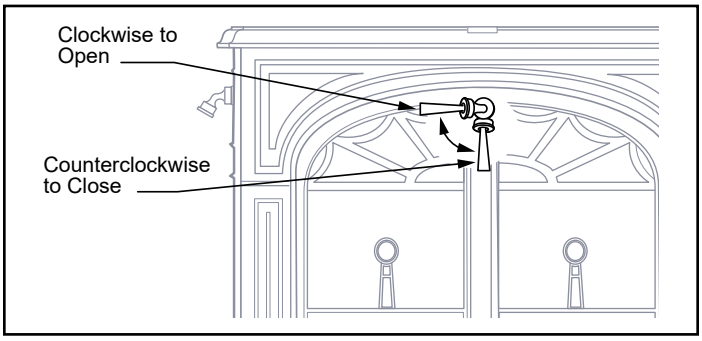


Figure 5.6 - To open the front doors, turn the handle clockwise.

⚠ WARNING

For safety and greatest efficiency, operate your stove only with all doors/griddles fully closed. The test standard for your stove when it is operated in this mode is UL 1482.

⚠ WARNING

DO NOT OPERATE THE STOVE WITH THE ASH DOOR OPEN. OPERATION WITH THE ASH DOOR OPEN CAN CAUSE AN OVER-FIRING CONDITION TO OCCUR. OVER-FIRING THE STOVE IS DANGEROUS AND CAN RESULT IN PROPERTY DAMAGE, INJURY OR LOSS OF LIFE.

Andirons Help Protect the Glass
Your stove has andirons to keep logs away from the glass panels. The andirons are essential to maintain clear fire viewing, and should be left in place during operation. Since the andirons may slightly hinder refueling through the front doors, most stove owners will prefer the convenience of top loading through the griddle. Do not place fuel between the andirons and the doors.

Burn Only High-Quality Wood
This appliance is designed to burn natural wood only; do not burn fuels other than that for which it was designed.

IMPORTANT: Do not burn any type of artificial or synthetic materials such as fire starter logs (containing wax) in this appliance. Never burn liquid-based fuels such as kerosene, gasoline or alcohol.

Burning any materials not allowed in these instructions, or over-firing the stove, may void the warranty.

You'll enjoy the best results when burning wood that has been adequately air-dried. The wood should be 18" - 20" (457-508 mm) in length. Avoid burning "green" wood that has not been properly seasoned. Do not burn construction materials; they often contain chemicals and metals that can damage the inside surfaces of the stove and pollute the air. Do not burn ocean driftwood; when it burns, the salt it contains will attack the cast iron.

The best hardwood fuels include oak, maple, beech, ash, and hickory that has been split, stacked, and air-dried outside under cover for at least one year.

If hardwood is not available, you can burn softwoods that include tamarack, yellow pine, white pine, Eastern red cedar, fir, and redwood. These should also be properly dried.

Store split wood under cover to keep it dry. Even for short-term storage, be sure to keep wood a safe distance from the heater and keep it out of the areas around the heater used for refueling and ash removal.

Surface Thermometer is a Valuable Guide to Operation
An optional surface thermometer tells you when to adjust the air control, and when to refuel, Figure 5.7.

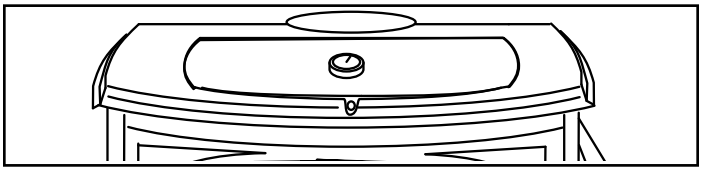


Figure 5.7 - Take temperature readings with a thermometer located in the middle of the griddle.

For example, when the thermometer registers at least 450°F (230°C) on the stove top after start-up you know the stove is hot enough and it may be time to close the catalyst bypass damper if a sufficient ember bed has also been established. Note that the stove will warm up much sooner than the chimney, though; a warm chimney is the key to easy, effective stove operation. Please review the *"Draft Management"* section of this manual to see how the size, type, and location of your chimney will affect your stove operation. When thermometer readings drop below 350°F. (175°C) it's time to adjust the air control for a higher burn rate or to reload the stove. A temperature reading over 650°F. (340°C) is a sign to reduce the air supply to slow the burn rate.

Use the following temperature ranges as a guide:

- Readings in the 350°-500°F. (175°-260°C) range indicate low to medium heat output.
- 500°-600°F. (260°-315°C) readings indicate medium heat output.
- Readings of 600°-700°F. (315-371°C) indicate high heat output. Operating your appliance continuously at griddle temperatures higher than 650° F (340°C) may damage the cast iron or enamel finish.

Use the Air Control Settings that Work Best for You
No single air control setting will fit every situation. Each installation will differ depending on the quality of the fuel, the amount of heat desired, and how long you wish the fire to burn; outdoor air temperature and pressure also affect draft.

The control setting also depends on your particular installation's "draft," or the force that moves air from the stove up through the chimney. Draft is affected by such things as the length, type, and location of the chimney, local geography, nearby obstructions, and other factors. See the *"Draft Management"* section of this manual for details on how the installation affects performance.

Too much draft may cause excessive temperatures in the appliance, and could even damage the stove. On the other hand, too little draft can cause backpuffing into the room and/or the "plugging" of the chimney.

How do you know if your draft is excessively high or low? Symptoms of too much draft include an uncontrollable burn or a glowing-red stove part. Signs of weak draft are smoke leaking into the room through the stove or chimney connector joints or low heat output.

In some newer homes that are well-insulated and weather-tight, poor draft may result from an insufficient air supply in the house. In such instances, an open window near the stove on the windward side of the house can provide the combustion air supply needed.

Another option for getting more combustion air to the stove is to duct air directly from outside to the stove. In some areas provisions for outside combustion air are required in all new construction.

This appliance is equipped to deliver outside air for combustion. An outside air adapter (available at your authorized Vermont Castings dealer) is required for installation and any 3" non combustible duct will need to supplied by the installer.

When first using the stove, keep track of the air control settings. You will quickly find that a specific setting will give you a fixed amount of heat. It may take a week or two to determine the amount of heat and the length of burn you should expect from various settings.

Most installations do not require a large amount of combustion air, especially if adequate draft is available. Do not for any reason attempt to increase the firing of your heater by altering the air control adjustment range outlined in these directions.

Use the following air control settings as a starting point to help determine the best settings for your installation. Each is described as a fraction of the total distance the lever may be moved from right to left.

F. Ash Disposal

⚠ WARNING

DO NOT OPERATE THE STOVE WITH THE ASH DOOR OPEN. OPERATION WITH THE ASH DOOR OPEN CAN CAUSE AN OVER-FIRING CONDITION TO OCCUR. OVER-FIRING THE STOVE IS DANGEROUS AND CAN RESULT IN PROPERTY DAMAGE, INJURY OR LOSS OF LIFE.

Routine ash removal is important for ease of maintenance, and is important for the stove's durability. Remove ash before it reaches the top of the ash pan. Check the level at least once a day. Every few days, clear any ash from the outer edges of the firebox. Most of the ash will fall through the grate. Stir the ash with a shovel or poker so that it falls through the grate slots.

IMPORTANT: Check the level of ash in the ash pan before reloading the stove. If the ash level is close to the top edge of the pan, empty the pan according to this procedure:

- Open the catalyst bypass damper.
- Open the griddle or front doors, and use a shovel or poker to stir excess ash through the ash slots in the grate down into the ash pan.
- Close the griddle or doors, and unlatch the ash door, Figure 5.8. It will pivot, swinging the ash pan out of the stove.

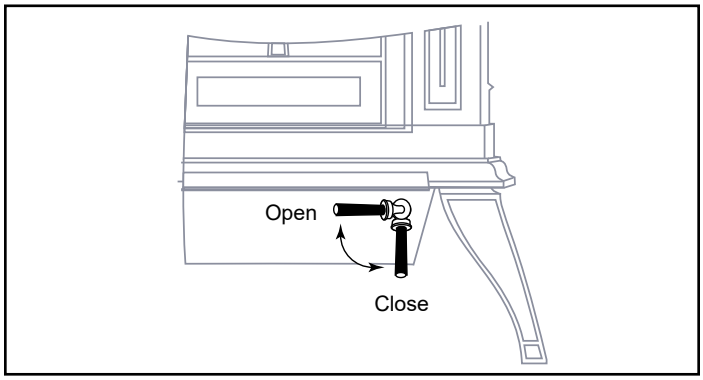


Figure 5.8- Turn the ashdoor handle clockwise to open and counterclockwise to close.

- Slide the cover onto the pan, making sure it is securely closed, Figure 5.9.

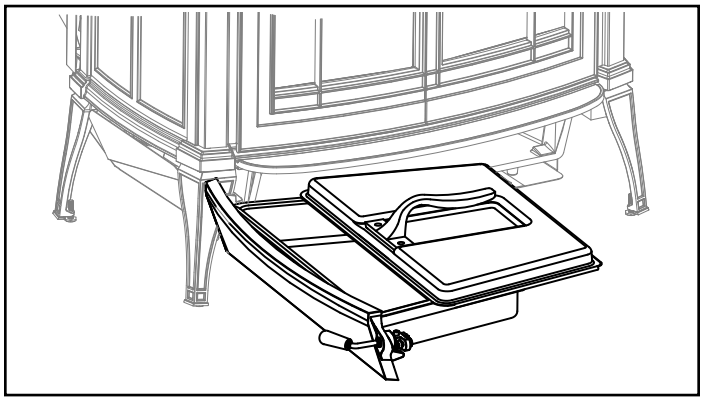


Figure 5.9 - Be sure the cover is securely attached before removing the ash pan.

- Remove the ash pan, making sure to keep it level.
- To keep the cover from sliding off and to keep ash from falling on the floor, do not tilt the ash pan forward.
- If the stove is in operation, close the ash door while disposing of the ash. You may need to lift the latch end of the door slightly to align the latch with the mating part on the stove bottom.
- Properly dispose of the ash in a metal container with a tight-fitting lid. Store the container outdoors away from all combustible material.
- Return the ash pan to its original position in the stove, and close and latch the ash door.

- **Do not operate the stove with the ash door open. This will result in over-firing, and could cause damage to the stove, void the warranty, or even lead to a house fire.**

Empty the ash pan regularly, typically every one to three days. The frequency will vary depending on how you operate your appliance: ash will accumulate faster at higher heat outputs.

Removed ash should be placed outdoors in a metal container with a tight-fitting lid. Keep the closed container of ash on a noncombustible floor or on the ground, well away from all combustible materials, pending final disposal. If the ash is disposed of by burial in soil or otherwise locally dispersed, it should be kept in the closed container until all cinders have thoroughly cooled.

⚠ CAUTION

Never use your household or shop vacuum cleaner to remove ash from the stove; always remove and dispose of the ash properly.

G. Draft Management

A stove is part of a system, which includes the chimney, the operator, the fuel, and the home. The other parts of the system will affect how well the stove works. When there is a good match between all the parts, the system works well.

Wood stove or insert operation depends on natural (unforced) draft. Natural draft occurs when the exhaust is hotter (and therefore lighter) than the outdoor air at the top of the chimney. The bigger the temperature difference, the stronger the draft. As the hot gases rise through the chimney they provide suction or 'draw' that pulls air into the stove for combustion. A slow, lazy fire with the stove's air inlets fully open indicates a weak draft. A brisk fire, supported only by air entering the stove through the normal inlets, indicates a good draft. The stove's air inlets are passive; they regulate how much air can enter the stove, but they don't move air into it.

Depending on the features of your installation - steel or masonry chimney, inside or outside the house, matched to the stove's outlet or oversized - your system may warm up quickly, or it may take a while to warm up and operate well. With an 'airtight' stove, one which restricts the amount of air getting into the firebox, the chimney must keep the stove's exhaust warm all the way to the outdoors in order for the stove to work well. Some chimneys do this better than others. Here's a list of features and their effects.

Masonry Chimney
Masonry is a traditional material for chimneys, but it can perform poorly when it serves an 'airtight' stove. Masonry is a very effective 'heat sink' - it absorbs a lot of heat. It can cool the chimney gases enough to diminish draft. The bigger the chimney, the longer it takes to warm up. It's often very difficult to warm up an outdoor masonry chimney, especially an oversized one, and keep it warm enough to maintain an adequate draft.

Steel Chimney
Most factory-made steel chimneys have a layer of insulation around the inner flue. This insulation keeps the chimney warm. The insulation is less dense than masonry, so a steel chimney warms up more quickly than a masonry chimney. Steel doesn't have the good looks of masonry, but it performs much better.

Indoor/Outdoor Location
Because the chimney must keep the smoke warm, it's best to locate it inside the house. This uses the house as insulation for the flue and allows some heat release into the home. An indoor chimney won't lose its heat to the outdoors, so it takes less heat from the stove to heat it up and keep it warm.

Chimney Height
The common wisdom tells us that a taller flue draws better than a short one. This isn't necessarily so. If a chimney is tall enough to meet the safety requirements of the 2/3/10 foot rule, then adding more height isn't the right answer to a draft problem. In fact it could make the problem worse by adding more mass to the chimney system, which must be warmed up, a distance from the heat source (the stove). Don't make a chimney taller unless you must in order to meet the safety rules, or unless there's some nearby feature causing a downdraft. Even then, there are downdraft-preventing chimney caps available, which are probably the smarter choice.

Flue Sizing
The inside size of a chimney for an 'airtight' stove should match the size of the stove's flue outlet. When a chimney serves an airtight stove, more is not better; in fact, it can be a disadvantage. Hot gases lose heat faster as they travel slower through a chimney; if we vent a stove with a six-inch flue collar (28 square inch area) into a 10 x 10" flue, the gases slow to one third their original speed. This allows the gases to cool more rapids, which weakens draft strength. If an oversized flue is also outside the house, the heat it absorbs gets transferred to the outdoor air and the flue usually stays cool.

It is common for a masonry flue, especially one serving a fireplace, to be oversized for the stove. It can take quite a while to warm up such a flue, and the results can be disappointing. The best solution to an oversized flue is an insulated steel chimney liner, the same diameter as the stove or inserts flue outlet; the liner keeps the exhaust warm, and the result is a stronger draft. An non-insulated liner is a second choice - the liner keeps the exhaust restricted to its original size, but the hot gases still must warm up the air around the liner. This makes the warm-up process take longer.

Pipe & Chimney Layout
Every turn the exhaust must take as it travels to the chimney top will slow it down. The ideal pipe and chimney layout is to vent vertically into a completely straight and vertical chimney. If you are starting from scratch, use this layout if possible. If the stovepipe must elbow to enter a chimney, locate the thimble about midway between the stove top and the ceiling. This achieves several goals: it allows the gases to speed up before they must turn, it leaves some pipe in the room for heat transfer, and it gives you long-term flexibility for installing a different stove without relocating the thimble.

There should be no more than eight feet of single-wall stove pipe between the stove and a chimney; longer runs can cool the exhaust enough to cause draft and creosote problems. With prefabricated chimney, bring it down to six to eight feet from the stove. With a masonry chimney, arrange the pipe so that it turns into the chimney within eight feet of the stove.

Single Venting
Each 'airtight' stove requires its own flue. If an airtight stove is vented to a flue that also serves an open fireplace, or a leakier stove, it's easier for the chimney draft to pull air in through those channels and performance of the stove suffers. Imagine a vacuum cleaner with a hole in the hose to understand the effect here. In some cases the other appliance can even cause a negative draft through the stove, and result in a dangerous draft reversal.

Creosote
Creosote is a by-product of slow wood-burning. It's an organic tar that can condense in the flue if it is present in the exhaust, slow-moving, and cools to less than 290°F (130°C). Condensed creosote is volatile, and can generate chimney fires if it gets hot enough. All the features that affect chimney draft also affect creosote condensation - so use whatever combination of installation features and operational steps that will encourage good draft and minimize creosote production.

Because letting the exhaust cool off and slow down is one of the keys to creosote accumulation, it makes sense to line a chimney to match the stove's outlet size, for safety reasons as well as performance. Canadian law requires a matching liner to serve any stove or insert vented through a fireplace chimney; in the US, the National Fire Protection Association (NFPA) recommends a chimney liner if the flue is more than three times bigger (in square area) than the outlet on the stove or insert. Some localities enforce the NFPA guidelines as part of their building codes.

Fuel
Even the best stove installation will not perform well with poor fuel. The best fuel is hardwood that has air-dried 12-18 months. Softwood burns, but not as long as hardwood. 'Green' wood contains a lot of moisture; it will burn, but some of the heat potential is used to boil the extra moisture from the wood. This reduces the amount of heat that reaches your home and can contribute to a creosote problem. There are moisture meters available for firewood; you can also judge your wood by its appearance and weight. If you get it green, lift a piece and get a sense of its weight; it can lose a third or more of its weight as it dries. Also look at the ends of a log; as it dries it shrinks and often cracks. The more weathered and cracked a piece is, the drier it is.

Dry wood burns readily with a good chimney draft. But with modern stoves, wood can be too dry and too volatile. Smoke and combustible gases can 'gas out' from the wood quickly and densely enough to overload the combustion system. If you hear a rumbling or roaring noise (like a propane torch) from the stove, that is a sign that the stove is over-firing.

Back-puffing
Back-puffing results when the fire produces volatile gases faster than the chimney draft pulls them out of the firebox. The gases back up in the firebox until they are concentrated enough and hot enough to ignite. If your stove back-puffs, the stove needs to cool down. You should open the catalyst bypass damper to let the smoke rise to the flue more quickly, allow more air into the firebox, avoid big loads of firewood and check that the wood moisture is not too low.

Draft Testing
An easy way to test your chimney draft is to close the stove's catalyst bypass damper, wait a few minutes to let the airflow stabilize, then see whether you can vary the strength of the fire by swinging the air control open and closed. Results are not always instant; you may need to wait a few minutes for a change in the air control setting to have an effect on the fire. If there's no change, then the draft isn't strong enough yet to let you close the catalyst bypass damper, and you'll need to open it for awhile longer and manage the fire with the air inlet until the draft strengthens. If you keep track of your burning habits and relate them to their effects on the stove's operation, you'll be rewarded with good performance and a safe system.

Negative Pressure
Good draft also depends on a supply of air to the stove; a chimney can't pull in more air than is available to it. Sluggish draft results when a house is tight enough to prevent the ready flow of air to the stove, or by competition between the stove and other equipment that sends indoor air outside - especially power-driven equipment like range hoods, clothes dryers, etc. If the chimney draws well with all other equipment turned off (or sealed, in the case of fireplaces and/or other stoves), then you simply need to be careful with timing the use of the other air consuming equipment. If you need to crack a nearby window or door to enable the chimney to flow well, it may be a good idea to install an outside-air intake to bring combustion air directly to the stove. An outside air kit is available to connect the stove directly to a source of outdoor combustion air.

Conclusion
Wood-burning is an art rather than a science. Once the stove and chimney system are in place, you can only vary your technique, mostly your timing, to achieve good results. If you keep track of your burning habits and relate them to their effects on the stove's operation, you'll be rewarded with good performance and year of reliable heating.

6 Maintenance

Keep Your Stove Looking New and Working Its Best
Let the fire in the stove go out and allow the stove to cool completely before beginning any maintenance procedure.

Care of the Cast Iron Surface
An occasional dusting with a dry rag will keep the painted cast iron of your appliance looking new.

The stove's paint can be touched up as needed. First, mask the areas, such as enameled parts, glass, or handles, around the spot to be painted. Clean the spot with a wire brush. Remove the griddle and set it aside. It is normal for the griddle to darken after use. You can clean it with a fine-bristle wire brush, or steel wool.

Then, touch up the stove with Vermont Castings' high temperature stove paint. Apply the paint sparingly; two light coats of paint are better than a single heavy one.

Care of the Porcelain Enamel Surface
Use a dry or slightly damp rag or soft brush to remove spills or stains. For difficult jobs that require a cleaning agent, use only a kitchen appliance cleaner or polish recommended for use on enamel surfaces.

If porcelain enamel becomes chipped or scratched during use, apply "enamel epoxy" to the damaged area and allow to dry. Once the epoxy has dried, sand the area to blend with surrounding area and apply appropriate color touch-up paint. Allow to dry completely before operating stove.

A. Glass Maintenance

Cleaning the Glass
Most of the carbon deposits on the glass will burn off during hot fires.

However, the ash residue that accumulates on the glass surface should be removed regularly to prevent etching. To clean the glass, follow this procedure:

- Be sure the glass is completely cool.
- Clean the glass with water or a cleaner made especially for this purpose. Do not use abrasive cleaners. Use cleaning agents sparingly and be sure to keep them off the outer surfaces of the stove.
- Rinse the glass thoroughly.
- Dry the glass completely.

Replace Broken Glass Immediately
Do not operate your stove if the glass in the doors is damaged.

If you need to replace the glass, use only the high temperature 5 mm ceramic glass supplied by Vermont Castings. Do not use substitutes.

Removing the Glass
1. Remove the right and left door assemblies by raising the door until the lower hinge pin clears its hole; then, angle the door bottom slightly outward and pull down to release the upper hinge pin. Place the doors face down on a padded work surface. Be especially careful with enameled doors.
2. Remove the screws that hold the glass retainer clips in place, and remove the clips.
3. Carefully lift the broken glass panel from the door.

Installing the Glass
Check the gasket around the window; it should be soft and resilient so that the glass will seal properly against the door. Replace the gasket if it has hardened or if it is compressed.

1. Center the glass on the gasket.
2. Secure the glass on both doors with the retainer clips. Tighten all screws, Figure 6.1.
3. Replace the doors on the stove.
4. Open and close the doors to check that they fit and work properly. Adjust as necessary.

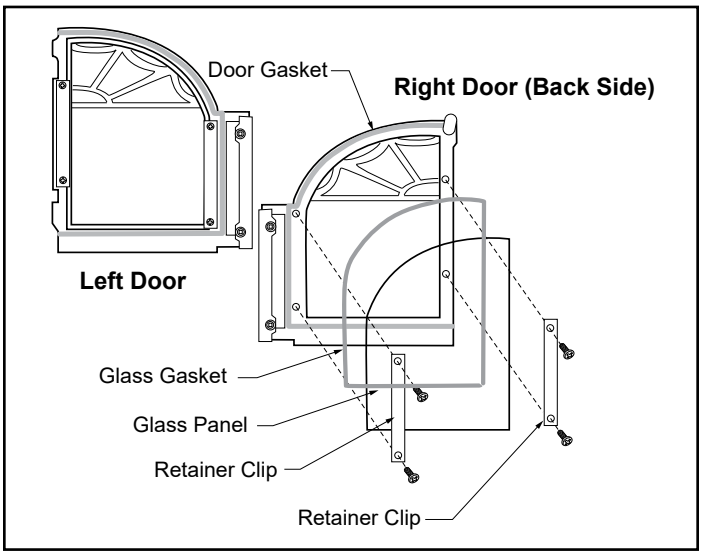


Figure 6.1 - Exploded view of the glass assembly for the right door.

B. Catalyst Bypass Damper Adjustment

Adjust the Catalyst Bypass Damper as Needed

The tension on this appliance's catalyst bypass damper is adjustable to compensate for compression of the gasket that seals the catalyst bypass damper to the upper fireback. To adjust the catalyst bypass damper:

1. Remove the griddle. Loosen the lock nut at the center of the catalyst bypass damper, Figure 6.2.
2. Turn the pressure screw approximately one half turn clockwise with an Allen wrench provided with your stove.
3. Tighten the lock nut. Prevent the pressure screw from turning as you tighten the nut. Re-test the damper.

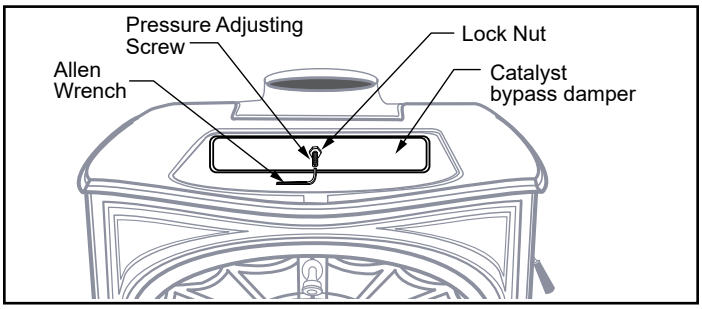


Figure 6.2 - Adjust the catalyst bypass damper with the Allen wrench.

Tighten the Catalyst Bypass Damper Handle as Needed

A handle on the left side of the stove controls the catalyst bypass damper. The handle attaches to the catalyst bypass damper rod with a set screw. Periodically check the set screw and tighten as necessary.

C. Front Door Adjustment

The load doors are factory adjusted for clearance, proper sealing and latch operation. However, the doors can sometimes shift in transit or from use and may need to be readjusted. The adjustment/alignment procedure is simple and only requires a 7/16" wrench and a few minutes. We have provided a detailed video explaining how to properly adjust and align the doors.

D. Ash Door Adjustment

Just like the load doors, the ash door is factory adjusted for properly operation and minimal sag. If the door does require adjustment to minimize sagging at the latch side, a simple adjustment requiring only a 7/16" wrench will get the door back into proper alignment. We have provided a detailed video explaining how to properly adjust the ash door.

Note: For video instruction please refer to www.vermontcastings.com. Click on the YouTube link ▶ located in the upper right hand corner next to the "Search" bar.

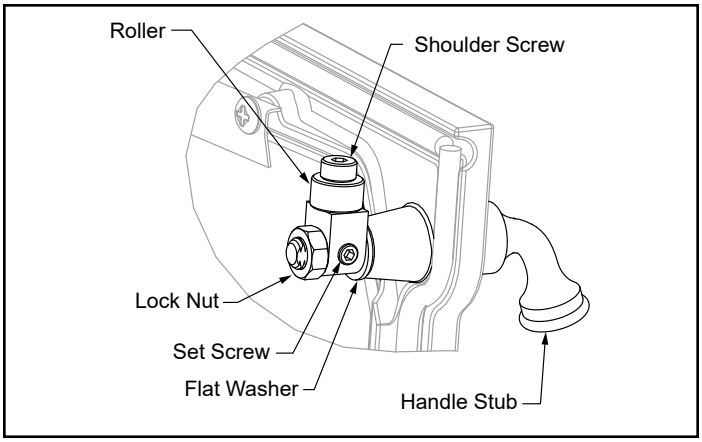


Figure 6.3 - Rotate pawl and/or remove flat washer to adjust latch.

E. Gasket Replacement

Replace the Stove Gaskets as Needed

Your appliance uses fiberglass rope gaskets to make a tight seal between some parts. With use, particularly on moving parts, gaskets can become brittle and compressed and can begin to lose their effectiveness. These will need periodic replacement.

The sizes of replaceable gasket are listed below, along with their applications.

Gasket Diameter.....And the Parts it Seals

5/16" The griddle to the stove top (wire reinforced gasket)

5/16" The catalyst bypass damper to the upper fireback

3/8" The front doors to the stove front; and the doors to each other.

3/8" The ash door to the front of the bottom panel

3/16" The outer glass panes to the door

Wait until the fire is out and the stove has cooled. Be sure to follow the standard safety procedure for working with dusty materials: wear safety goggles and a dust mask.

The procedure for replacing gaskets is the same, regardless of the gasket location. Follow these steps:

1. Remove the existing gasket by grasping an end and pulling firmly, Figure 6.4.
2. Use a wire brush or the tip of a screwdriver to clean the channel of any remaining cement or bits of gasket. Remove stubborn deposits of cement with a cold chisel if necessary, Figure 6.4.

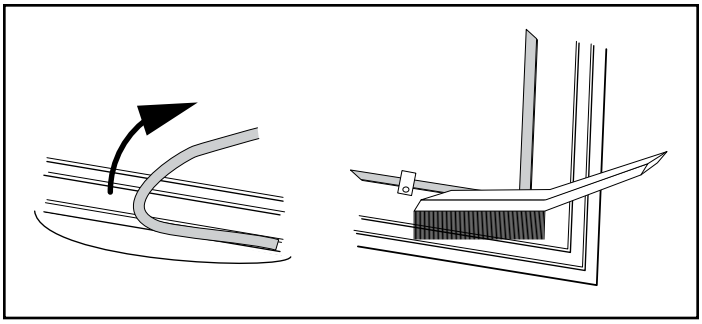


Figure 6.4 - Remove gasket then clean channel with wire brush.

3. Determine the correct length of the appropriate-sized gasket by laying it out in the channel. Allow an extra 1-2" (25-50 mm), and mark the spot to be cut.
4. Remove the gasket from the channel, place it on a wood cutting surface, and cut it at the marked spot with a utility knife.

Twist the ends slightly to keep the gasket from unraveling.

5. Lay an unbroken 1/8" (3 mm) bead of silicone or cement in the newly-cleaned channel, Figure 6.5.

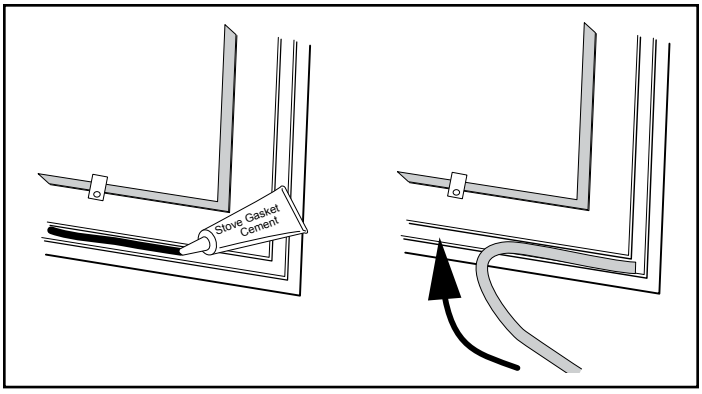


Figure 6.5 - Lay a bead of gasket silicone or cement then press gasket in place.

6. Starting at one end, press the gasket into the channel, Figure 6.5. Ensure a good joint where the gasket meets before trimming any excess. Do not overlap the gasket ends or leave ends with ragged edges.
7. Press the gasketed part firmly against its normal mating surface to seat the gasket evenly in its channel. Close and latch the door to do this, or tap other parts with the rubber mallet (or hammer/block of wood).
8. Clean any excess cement from around the channel, then let the cement that holds the new gasket dry thoroughly.
9. The stove's doors may need adjustment after you have regasketed them. Initially, it may require loosening the latch to accommodate the new gasket; after a few weeks, it may need tightening to compensate for compression of the new gasket. See Figure 6.3 for directions on adjusting the latches.

All Gasketed Construction Gaskets

Other gaskets form seals between all other non-moving parts, but these are not subject to the same wear and deterioration as gaskets on moving parts. It is unlikely that you will ever need to replace these gaskets unless the involved parts are disassembled and then put back together. If this is the case, the job should be done only by a qualified service technician.

5/16" diameter gasket seals the following parts:

- The lower fireback to the back panel
- The left and right air plates (inner sides)
- All connections between the stove plates.

F. The Chimney System

Creosote

Your appliance is designed to reduce creosote build-up significantly. However, regular chimney inspection and maintenance must still be performed. For safety, good stove performance, and to protect your chimney and chimney connector, inspect your chimney and chimney connector on a regular schedule. Clean the system if necessary. Failure to keep the chimney and connector system clean can result in a serious chimney fire.

When wood is burned slowly, it produces tar, organic vapors and moisture that combine 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 within the flue system that can damage the chimney and overheat adjacent combustible material. If a significant layer of creosote has accumulated —1/8" (3 mm) or more — it should be removed to reduce the risk of a chimney fire.

You can never be too safe. Contact your local fire authority for information on what to do in the event of a chimney fire, and have a clearly understood plan on how to handle one.

If you do experience a chimney fire, act promptly to:

- Close the catalyst bypass damper and air control lever.
- Get everyone out of the house.
- Call the Fire Department.

Inspect the system every two weeks during the heating season as part of a regular maintenance schedule. To inspect the chimney, let the stove cool completely. Then, using a mirror and a strong light, sight up through the flue collar into the chimney flue. If you cannot inspect the flue system in this fashion, the stove must be disconnected to provide better viewing access.

Clean the chimney using a brush the same size and shape as the flue liner. Flexible fiberglass rods are used to run the brush up and down the liner, causing any deposits to fall to the bottom of the chimney where they can be removed through the clean-out door.

Clean the chimney connector by disconnecting the sections, taking them outside, and removing any deposits with a stiff wire brush. Reinstall the connector sections after cleaning, being sure to secure the joints between individual sections with sheet metal screws.

If you cannot inspect or clean the chimney yourself, contact your local Vermont Castings dealer or a professional chimney sweep.

Maintenance Schedule - The Stove

Daily:

- Clear any ash build-up from around the air holes and combustion flow path in the lower fireback.
- Ashes should be removed before they reach the top of the ash pan. Check accumulation at least once a day.
- Keep the area around the stove clear of any combustible materials such as wood, furniture or clothing.

Two Months:

- Check door handle to be sure it is working properly. Gasketing becomes compressed after a period of time. Adjust handle tightness if necessary.
- Check leg bolts and heat shield screws; tighten if necessary.

Annual Spring Cleaning:

- Check gasketing for wear, and replace if necessary.
- Remove ashes from the ash pan and replace with a moisture absorbing material (such as kitty litter) to keep the interior of the stove dry.
- Clean the dust from the inner sides of bottom, rear or pipe heat shields if your stove is equipped with them. Clean surfaces are better heat reflectors than dirty surfaces.
- Touch up the black paint.
- Inspect for and remove ash build-up behind the combustion package. This should be done in conjunction with annual cleaning of the chimney connector. Inspect the passage behind the combustion package (a mirror will be helpful) and vacuum away ash using a flexible vacuum hose inserted in the passage, Figure 6.6.

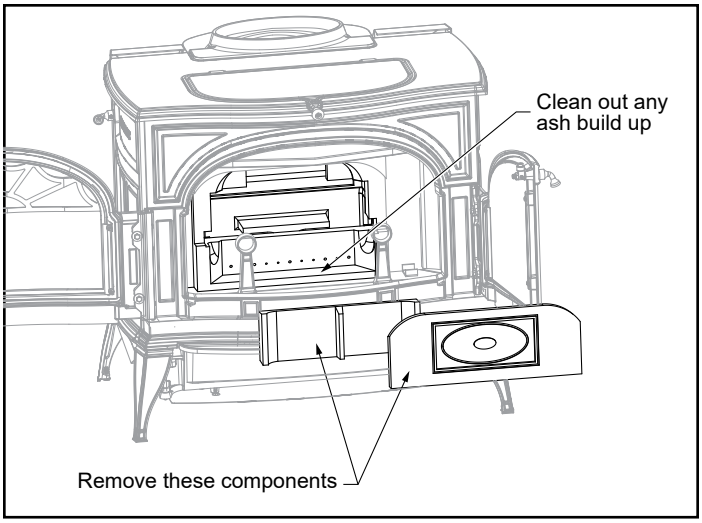


Figure 6.6 - Inspect and clean out ash accumulation behind the combustion system.

The Chimney Connector

Two Weeks

- Inspect the chimney connector and chimney. Clean if necessary.

Two Months:

- Inspect the chimney and chimney connector. Pay particular attention to the horizontal runs of chimney connector, and the elbows. Clean the system if necessary.

Annual Spring Cleaning:

- Disassemble the chimney connector and take it outdoors for inspection and cleaning. Replace weak sections of connector.
- Inspect the chimney for signs of deterioration. Repairs to a masonry chimney should be made by a professional mason. Replace damaged sections of prefabricated chimney. Your local Vermont Castings dealer or a chimney sweep can help determine when replacement is necessary.
- Thoroughly clean the chimney.

G. The Catalytic Element

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.

Under normal operating conditions, the catalytic combustor should remain active for two to six years (depending on the amount of wood burned). However, it is important to monitor the combustor periodically to ensure that it is functioning properly, as well as to determine when it needs to be replaced. A non-functioning combustor will result in a loss of heating efficiency, and an increase in creosote and emissions.

Inspection and Cleaning

Inspect the combustor for fly ash accumulation and physical damage two to three times per year. Clean the combustor as needed.

The refractory package that houses the catalytic combustor should be inspected for a buildup of fly ash and cleaned if necessary. This may be done when you examine the combustor.

When to Suspect a Combustor Problem

The best way to evaluate the performance of your appliance's combustor is to observe the amount of smoke leaving the chimney — both when the combustor has "lighted-off" and when it has not. Follow these steps:

- With a fire going and the combustor properly activated, with the catalyst bypass damper closed to route smoke through it as described in the Operation Section, go outside and observe the smoke leaving the chimney.
- Then, open the stove catalyst bypass damper and once again check the smoke leaving the chimney.

You should see significantly more smoke when the stove catalyst bypass damper is open and exhaust does not pass through the combustor. However, be careful not to confuse smoke with steam from wet wood. Steam dissipates in the air quickly; smoke does not.

If this test indicates a problem, consider other possible factors as well, such as the weather or a change in the quality of your fuel. In warm weather, draft is weaker than it is in colder winter weather, and fires can burn sluggishly. Small, hot fires are a good solution under these conditions.

Burning "green" (insufficiently seasoned) wood will result in poorer performance than burning properly seasoned fuel. Reloading with green wood can also thermal shock the catalyst, resulting in cracking, or the eventual fallout, of the ceramic honeycomb substrate. You may have to run your stove hotter (more air) to achieve acceptable performance using green or wet wood.

Also, consider any changes in your operating routine.

Once you have ruled out any other possible causes for a decline in performance, inspect and clean the combustor if necessary. Be sure to protect any surface you use for setting the stove parts aside.

Inspecting the Combustor

Remove access door and inner fireback. Remove the catalytic combustor by lifting and sliding it towards you, Figure 6.7.

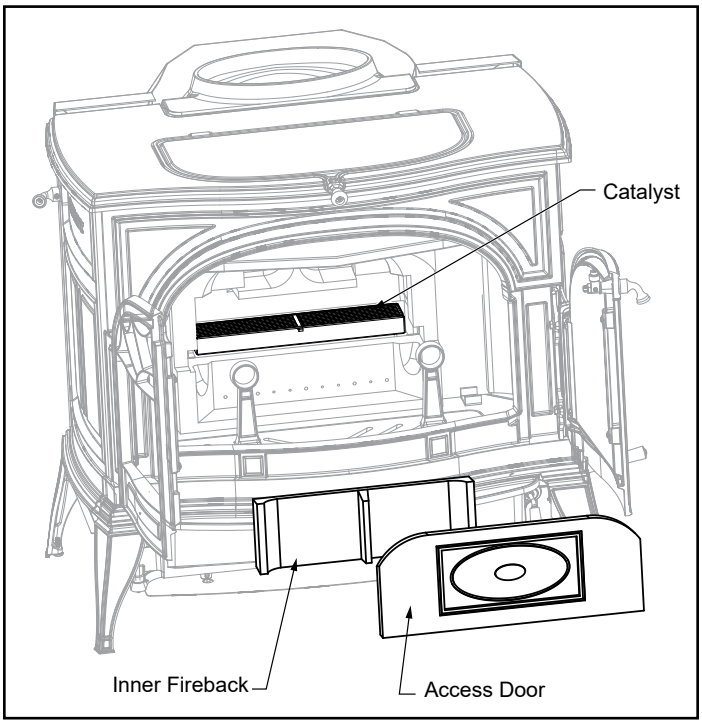


Figure 6.7 - Inspect the catalytic combustor.

To assure a long life for the combustor, it is recommended to service the combustor on a regular basis based on the amount of use. This procedure takes about five (5) minutes and requires no tools except for a vacuum if cleaning is necessary.

Cleaning the Combustor

1. Check the combustors honeycomb-like element for a buildup of fly ash. If any is evident, take the combustor outside and clean it by blowing air gently through it. Do not push anything through the honeycomb; do not use compressed air to clear the passages. Such abrasion can scrape the thin coating of platinum (the catalyst) off the ceramic base, shortening the catalyst's life and reducing its effectiveness.
2. Inspect the element for damage or degradation. Although small hairline cracks will not affect performance, the element should be essentially intact. If the element is broken in pieces or has sections missing, it should be replaced. Call your local Vermont Castings Authorized Dealer for a replacement element.
3. If the element is in good condition and clean, re-install it in the stove and replace the refractory inner fireback and access door.

Operate the stove in your usual manner for two weeks, inspecting the chimney and the chimney connector frequently during this period.

If creosote does not build up as fast, it is likely that the performance change was caused by fly ash deposits on the catalytic element. However, continue the inspections of the chimney system for a few weeks to ensure that proper performance continues.

If you continue to find a significant creosote buildup or if you continue to see excessive smoke from the chimney, the catalytic element will need to be replaced. Contact your nearest Vermont Castings' Authorized Dealer for information about a replacement element.

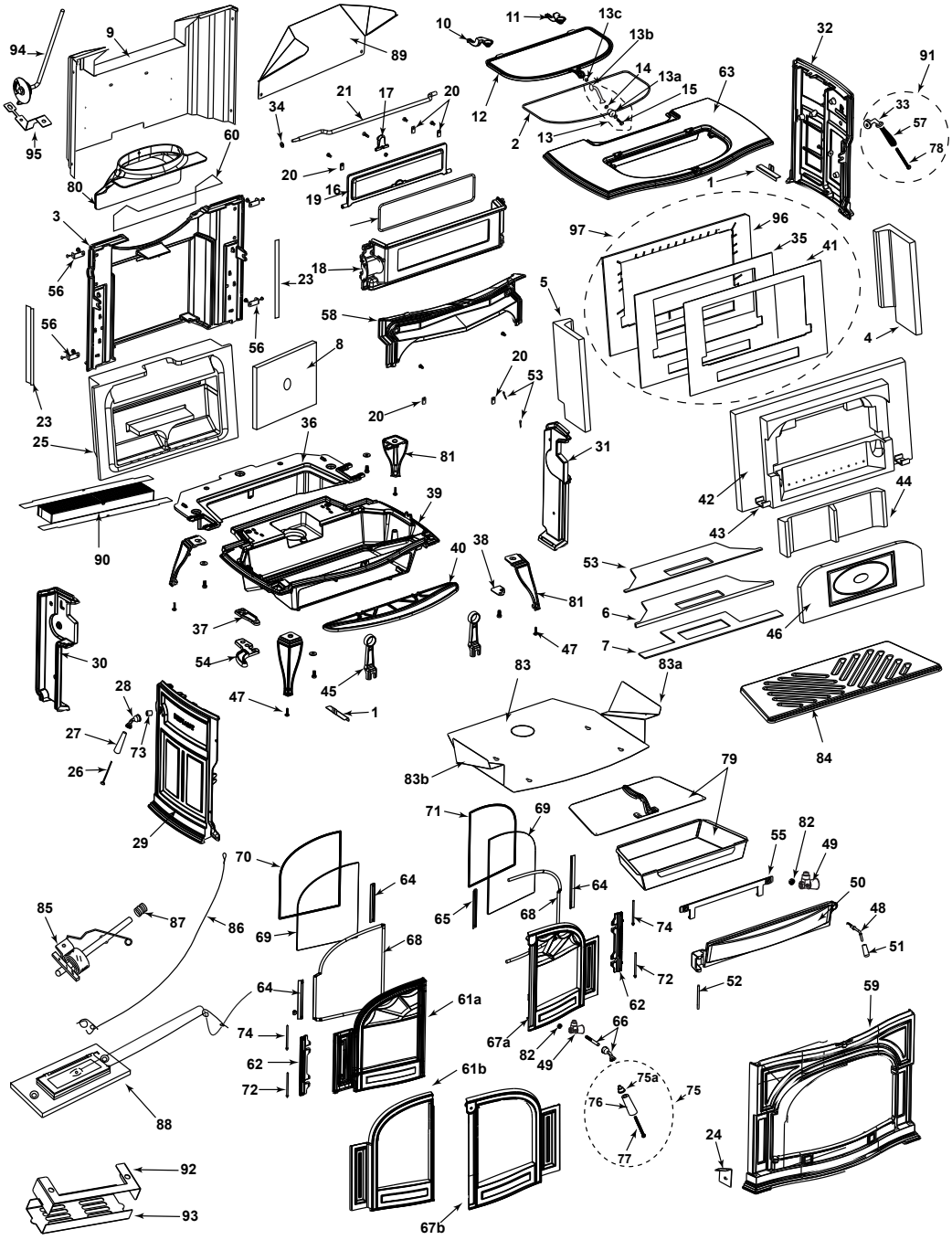
NOTE: Use only the replacement catalyst supplied by a Vermont Castings dealer.

VERMONT CASTINGS™ **Service Parts**

Defiant CAT-C

Beginning Manufacturing Date: Oct 2019
Ending Manufacturing Date: Active

1975-CAT-C (Classic Black)
1976-CAT-C (Biscuit) - Ending Manufacturing Date: Jan 2022
1977-CAT-C (Majolica Brown)
1979-CAT-C (Bordeaux)
1980-CAT-C (Twilight)
1975T-CAT-C (Classic Black w/Transition Doors)



Part number list on following page.

04/23

IMPORTANT: THIS IS DATED INFORMATION. Parts must be ordered from a dealer or distributor. **Hearth and Home Technologies does not sell directly to consumers**. Provide model number and serial number when requesting service parts from your dealer or distributor.

ITEM	DESCRIPTION	COMMENTS	PART NUMBER	Stocked at Depot
1	Brick Support Bracket		30005279	
2	Griddle Gasket	10 Ft	1-00-1203668	**Y**
3	Back		30005242A	
4	Refractory, Right End		30005206	
5	Refractory, Left End		30005207	
6	Refractory Support		30005233	
7	Gasket, Cast Base		SRV8344-000	
8	Back Insulation Board		30005269	
9	Outer Back		30005249	
10	Griddle Quadrant, Left		30002399A	
11	Griddle Quadrant, Right		30002401A	
12	Griddle		30005257A	
13	Complete Griddle Handle Assembly		30002775	**Y**
13a	Griddle Handle, Wood		1600661	**Y**
13b	Griddle Handle, CRS-BN1		30002715	
13c	Nut, Hex 1/4-20	Pkg of 10	1203210-10	
14	Griddle Handle Bushing	Pkg of 10	1201900-10	
15	Griddle Handle Bolt	Pkg of 10	1201308-10	
16	Damper Gasket	15 Ft	1-00-1203588	**Y**
17	Damper Ramp		1300643	
18	Damper Housing		30002821A	
19	Damper		30002816	
20	Damper Tab	Pkg of 10	1601488-10	
21	Damper Rod		1600065	
23	Gasket, Back Refractory	10 Ft	1-00-30005270	
24	Rheostat Bracket		30002863	
25	Refractory, Engine - E/D		30005202	
26	Damper Handle Screw	Pkg of 10	1201310-10	
27	Damper Handle		1600664	**Y**
28	Damper Handle w/Screw Assembly		30002720A	**Y**
29	Left Side	Classic Black	30002832A	
		Biscuit	SRV30002872	
		Bordeaux	SRV30006697	
		Majolica Brown	SRV30004834	
		Twilight	SRV30007126	
30	Left Air Manifold		30002818	
31	Right Air Manifold		30005243	

Additional service part numbers appear on following page.

IMPORTANT: THIS IS DATED INFORMATION. Parts must be ordered from a dealer or distributor. **Hearth and Home Technologies does not sell directly to consumers**. Provide model number and serial number when requesting service parts from your dealer or distributor.

ITEM	DESCRIPTION	COMMENTS	PART NUMBER	Stocked at Depot
32	Right Side	Classic Black	30002831A	
		Biscuit	SRV30002871	
		Bordeaux	SRV30006698	
		Majolica Brown	SRV30004835	
		Twilight	SRV30007127	
33	Thermostat Handle Base		30002716	**Y**
34	Washer Damper Rod	Pkg of 10	30007257-10	
35	Refractory Gasket Plate, S/S (Included w/SRV8787-021)	**No longer available**	SRV8000-008	
36	Inner Bottom		30005241	
37	Top Ashdoor Hinge	**No longer available**	1-00-30002836	
	Ash Door w/Hinge and Support	Must order Set	SRV30002810	
	Bolt, 5/16-18 x 1	Pkg of 12	27887/12	
	Nut, 5/16-18 x	Pkg of 12	SRV8787-007/12	
38	Door Handle Bracket		30002844	
39	Bottom		30005240A	
40	Ashlip	Classic Black	30002811A	
		Biscuit	SRV30002870	
		Bordeaux	SRV30006696	
		Majolica Brown	SRV30004833	
		Twilight	SRV30007125	
41	Gasket, Fireback (Included w/SRV8787-021)	**No longer available**	30005209	
42	Refractory, Fireback		30005203	
43	Retainer, Fireback Refractory	Qty 2 req	30005248	
44	Refractory, Inner Cover		30005205	**Y**
45	Andiron		30002827A	**Y**
46	Refractory, Access Cover		30007252	
47	Leg Leveler	Pkg of 10	1201745-10	
48	Ashdoor Handle Shaft		30005301	
49	Pawl Assembly, 3/4 Short Adj.		30005157	**Y**
49a	Spring Washer	Pkg of 10	63D0069-10	
50	Ashdoor (Post 0081391652 must order SRV30002810)	Pre 0081391652	30002810A	
50a	Ashdoor Gasket	15 Ft	1-00-1203589	
51	Ashdoor Handle, Wood		1600663	**Y**
52	Hinge Hardware		1-00-2826	
53	Gasket, Ceramic Fiber		SRV30007513	
54	Ashdoor Bottom Hinge Support	**No longer available**	1-00-1300642	
		Must order Set	SRV30002810	
	Bolt, 5/16-18 x 1	Pkg of 12	27887/12	
	Nut, 5/16-18 x	Pkg of 12	SRV8787-007/12	

Additional service part numbers appear on following page.

IMPORTANT: THIS IS DATED INFORMATION. Parts must be ordered from a dealer or distributor. **Hearth and Home Technologies does not sell directly to consumers**. Provide model number and serial number when requesting service parts from your dealer or distributor.

ITEM	DESCRIPTION	COMMENTS	PART NUMBER	Stocked at Depot
55	Ashpan Bracket		30001908A	
56	Rear Side Bracket		30002845	
57	Thermostat Handle		1600660	**Y**
58	Airwash Manifold, Front		30005244	
59	Front	Classic Black	30002830A	
		Biscuit	SRV30002873	
		Bordeaux	SRV30006699	
		Majolica Brown	SRV30004836	
		Twilight	SRV30007128	
60	Flue Collar Gasket		1-00-30002422	**Y**
61a	Left Door (Shell Enamel Parts)	Classic Black	30002813A	
		Biscuit	SRV30002876	
		Bordeaux	SRV30006703	
		Majolica Brown	SRV30004842	
		Twilight	SRV30007132	
	Left Door Sub Assembly (Shell Enamel Parts) (Does not contain glass or glass gasket)	Classic Black	30002854	
		Biscuit	30002879	
		Bordeaux	30006773	
		Majolica Brown	30004840	
		Twilight	30007133	
61b	Left Door (Transition Door Enamel)	Classic Black	30007091A	
		Biscuit	SRV30007093	
		Bordeaux	SRV30007097	
		Majolica Brown	SRV30007095	
		Twilight	SRV30007109	
	Left Door Sub Assembly (Transition Door Enamel)	Classic Black	30007175	
		Biscuit	30007177	
		Bordeaux	30007179	
		Majolica Brown	30007181	
		Twilight	30007183	
62	Door Hinge Strip		1300645A	
63	Top	Classic Black	30002834A	
		Biscuit	SRV30002874	
		Bordeaux	SRV30006700	
		Majolica Brown	SRV30004837	
		Twilight	SRV30007129	
64	Glass Clip		30001715	
65	Glass Clip (Right Door Only)		30001716	
66	Front Door Handle and Shaft		30002717	**Y**

Additional service part numbers appear on following page.

IMPORTANT: THIS IS DATED INFORMATION. Parts must be ordered from a dealer or distributor. **Hearth and Home Technologies does not sell directly to consumers**. Provide model number and serial number when requesting service parts from your dealer or distributor.

ITEM	DESCRIPTION	COMMENTS	PART NUMBER	Stocked at Depot
67a	Right Door (Shell Enamel Parts)	Classic Black	30002812A	
		Biscuit	SRV30002875	
		Bordeaux	SRV30006702	
		Majolica Brown	SRV30004841	
		Twilight	SRV30007131	
	Right Door Sub Assembly (Shell Enamel Parts) (Does not contain glass or glass gasket)	Classic Black	30002853	
		Biscuit	30002878	
		Bordeaux	30006772	
		Majolica Brown	30004839	
		Twilight	30007134	
67b	Right Door (Transition Door Enamel)	Classic Black	30007090A	
		Biscuit	SRV30007092	
		Bordeaux	SRV30007096	
		Majolica Brown	SRV30007094	
		Twilight	SRV30007108	
	Right Door Sub Assembly (Transition Door Enamel)	Classic Black	30007176	
		Biscuit	30007178	
		Bordeaux	30007180	
		Majolica Brown	30007182	
		Twilight	30007184	
68	Door Gasket	15 Ft	1-00-7000910	**Y**
69	Glass Gasket	10 Ft	1-00-1186258229	**Y**
70	Left Door Glass		30005247	
71	Right Door Glass		30005247	
72	Lower Door Hinge Pin		30002727	**Y**
73	Spacer (For Damper Rod)	Pkg of 10	1201779-10	
74	Upper Door Hinge Pin		30002727	**Y**
75	Complete Handle Assembly		30004175K	**Y**
75a	Handle Base Stub		30002714	**Y**
76	Wood Handle		1600664	**Y**
77	Handle Bolt	Pkg of 10	1201310-10	
78	Thermostat Handle Botl	Pkg of 10	1201243-10	
79	Ash Pan Assembly		30001690	
80	Flue Collar	Classic Black	30001576A	
		Biscuit	SRV30002947	
		Bordeaux	SRV30006701	
		Majolica Brown	SRV30004815	
		Twilight	SRV30007130	

Additional service part numbers appear on following page.

IMPORTANT: THIS IS DATED INFORMATION. Parts must be ordered from a dealer or distributor. **Hearth and Home Technologies does not sell directly to consumers**. Provide model number and serial number when requesting service parts from your dealer or distributor.

ITEM	DESCRIPTION	COMMENTS	PART NUMBER	Stocked at Depot
81	Leg	Classic Black	30002835A	
		Biscuit	SRV30002877	
		Bordeaux	30006695A	
		Majolica Brown	30004843A	
		Twilight	SRV30007124	
82	Jam Nut, Hex Head	Pkg of 10	1203290-10	
83	Bottom Heat Shield		30005037	
83a	Bottom Heat Shield, Right Wing		30005038	
83b	Bottom Heat Shield, Left Wing		30005039	
84	Grate Bottom		30005234A	
85	Thermostat Assembly		5005470	**Y**
86	Cable Assembly	Call Tech	5005471	
87	Thermostat Friction Spring	Pkg of 10	1201846-10	
88	Primary Air Valve Assembly		30005275	
89	Heat Plate Vertical Flue		30005265	
90	Catalyst, Ceramic		30006623	
91	Thermostat Handle Assembly		30007067	
92	Primary Air Cover		30007069	
93	Primary Air Base		30007071	
94	Temperature Probe		30007274	
95	Braket, Temperature Probe		30007278	
96	Gasket, Slotted Refractory (Included w/SRV8787-021)	**No longer available**	SRV8344-001	
97	Fireback Plate & Gaskets		SRV8787-021	
	Finish Bag		SRV8000-007	
	Warming Shelf Kit	Classic Black	0000210	
		Biscuit	0000211	
		Bordeaux	0000218	
		Majolica Brown	0000217	
		Twilight	0000219	
	Shelf	Classic Black	30002823A	
		Biscuit	SRV30002900	
		Bordeaux	SRV30006704	
		Majolica Brown	SRV30004844	
		Twilight	SRV30007135	
	Dragon Bracket	Classic Black	1302220A	
		Biscuit	SRV30002948	
		Bordeaux	30006690A	
		Majolica Brown	SRV30004818	
		Twilight	SRV30007075	

Additional service part numbers appear on following page.

8 Warranty

Hearth & Home Technologies LLC
LIMITED LIFETIME WARRANTY

Hearth & Home Technologies LLC ("HHT") extends the following warranty for HHT gas, wood, pellet and electric hearth appliances (each a "Product" and collectively, the "Product(s)") and certain component parts set forth in the table below ("Component Part(s)") that are purchased from a HHT authorized dealer or distributor.

WARRANTY COVERAGE:

HHT warrants that the Products and their Component Parts will be free from defects in materials and workmanship for the applicable period of Warranty coverage set forth in the table below ("Warranty Period"). If a Product or Component Parts are found to be defective in materials or workmanship during the applicable Warranty Period, HHT will, at its option, repair the applicable Component Part(s), replace the applicable Component Part(s), or refund the purchase price of the applicable Product(s). The maximum amount recoverable under this Warranty is limited to the purchase price of the Product. This Warranty is transferable from the original purchaser to subsequent owners, but the Warranty Period will not be extended in duration or expanded in coverage for any such transfer. This Warranty is subject to conditions, exclusions, and limitations as described below.

WARRANTY PERIOD:

Warranty coverage begins at the date of installation. In the case of new home constructions, Warranty coverage begins on the date of first occupancy of the dwelling or six months after the sale of the Product(s) by an independent, authorized HHT dealer or distributor, whichever occurs earlier. However, the Warranty coverage shall commence no later than 24 months following the date of Product shipment from HHT, regardless of the installation or occupancy date.

The term "Lifetime" in the table below is defined as: 20 years from the beginning date of warranty coverage for gas appliances, and 10 years from the beginning date of warranty coverage for wood and pellet appliances. These time periods reflect the minimum expected useful lives of the designated Component Parts under normal operating conditions.

Warranty Period		**HHT Manufactured Appliances and Venting**					
Component Parts	Labor	Gas	Pellet	Wood	Electric	Venting	Component Parts Covered by this Warranty
1 Year		X	X	X		X	All parts including handles, external enameled components and other material except as covered by Warranty Conditions, Warranty Exclusions, and Warranty Limitations listed
2 Years					X		All parts except as covered by Warranty Conditions, Warranty Exclusions, and Warranty Limitations listed
2 years			X	X			Igniters, Auger Motors, Electronic Components, and Glass
		X					Electrical components limited to modules, remotes/wall switches, valves, pilots, blowers, junction boxes, wire harnesses, transformers and lights (excluding light bulbs)
		X		X			Molded Refractory Panels, Glass Liners
3 years			X				Firepots, burnpots, mechanical feeders/auger assemblies
5 years	1 year	X					Vent Free Burners, Vent Free Logs
			X	X			Castings, Medallions and Baffles
6 years	3 years			X			Catalysts
7 years	3 years		X	X			Manifold tubes, HHT Chimney and Terminations
10 years	1 year	X					Burners, logs and refractory
Limited Lifetime	3 years	X	X	X			Firebox and heat exchanger, FlexBurn® System (engine, inner cover, access cover and fireback)
1 Year	None	X	X	X	X	X	All purchased replacement parts

WARRANTY CONDITIONS:

- Because HHT cannot control the quality of any Products sold by unauthorized sellers, this Warranty only covers Products that are purchased through an HHT authorized dealer or distributor unless otherwise prohibited by law; a list of HHT authorized dealers is available on the HHT branded websites.
- This Warranty is only valid while the applicable Product remains at the site of original installation.
- This Warranty is only valid in the country in which the HHT authorized dealer or distributor that sold the applicable Product is authorized to sell applicable Product.
- Contact your installing distributor or dealer for Warranty service. If the installing dealer or distributor is unable to provide necessary parts, contact the nearest HHT authorized dealer or supplier. Additional service fees may apply if you are seeking Warranty service from a dealer other than the dealer from whom you originally purchased the applicable Product.
- No HHT consumer should bear cost of warranty service or costs incurred while servicing warranty claims (i.e., travel, gas, or mileage) when the service is performed within the terms of this Warranty. Check with your dealer or distributor in advance for any costs to you when arranging a warranty call. Travel and shipping charges for parts are not covered by this Warranty.

WARRANTY EXCLUSIONS:

This Warranty does not cover the following:

- Changes in surface finishes as a result of normal use. As a heating appliance, some changes in color of interior and exterior surface finishes may occur. This is not a flaw and is not covered under the Warranty.
- Damage to printed, plated, or enameled surfaces caused by fingerprints, accidents, misuse, scratches, melted items or other external sources and residues left on the plated surfaces from the use of abrasive cleaners or polishes.
- Repair or replacement of parts that are subject to normal wear and tear during the Warranty Period are not covered. These parts include: paint, wood and pellet gaskets, firebricks, grates, flame guides, batteries and the discoloration of glass.
- Minor expansion, contraction, or movement of certain parts causing noise. These conditions are normal and complaints related to this noise are not covered by this Warranty.
- Damages resulting from: (1) failure to install, operate, or maintain the applicable Product in accordance with the installation instructions, operating instructions, and listing agent identification label furnished with the applicable Product; (2) failure to install the applicable Product in accordance with local building codes; (3) shipping or improper handling; (4) improper operation, abuse, misuse, continued operation with damaged, corroded or failed components, accident, or improperly/incorrectly performed repairs; (5) environmental conditions, inadequate ventilation, negative pressure, or drafting caused by tightly sealed constructions, insufficient make-up air supply, or handling devices such as exhaust fans or forced air furnaces or other such causes; (6) use of fuels other than those specified in the operation instructions; (7) installation or use of components not supplied with the applicable Product or any other components not expressly authorized and approved by HHT; (8) modification of the appliance not expressly authorized and approved by HHT in writing; and/or (9) interruptions or fluctuations of electrical power supply to the applicable Product.
- Non-HHT venting components, hearth connections or other accessories used in conjunction with the applicable Product.
- Any part of a pre-existing fireplace system in which an insert or a decorative gas applicable Product is installed.
- HHT's obligation under this Warranty does not extend to the Product's capability to heat the desired space. Information is provided to assist the consumer and the dealer in selecting the proper Product for the application. Consideration must be given to the Product location and configuration, environmental conditions, insulation and air tightness of the structure.

This warranty is void if:

- The applicable Product has been over-fired, operated in atmospheres contaminated by chlorine, fluorine, or other damaging chemicals. Over-firing can be identified by, but not limited to, warped plates or tubes, deformation/warping of interior cast iron structure or components, rust colored cast iron, bubbling, cracking and discoloration of steel or enamel finishes.
- The applicable Product is subjected to prolonged periods of dampness or condensation.
- There is any damage to the applicable Product due to water or weather damage which is the result of, but not limited to, improper chimney or venting installation.

LIMITATIONS OF REMEDIES AND LIABILITY:

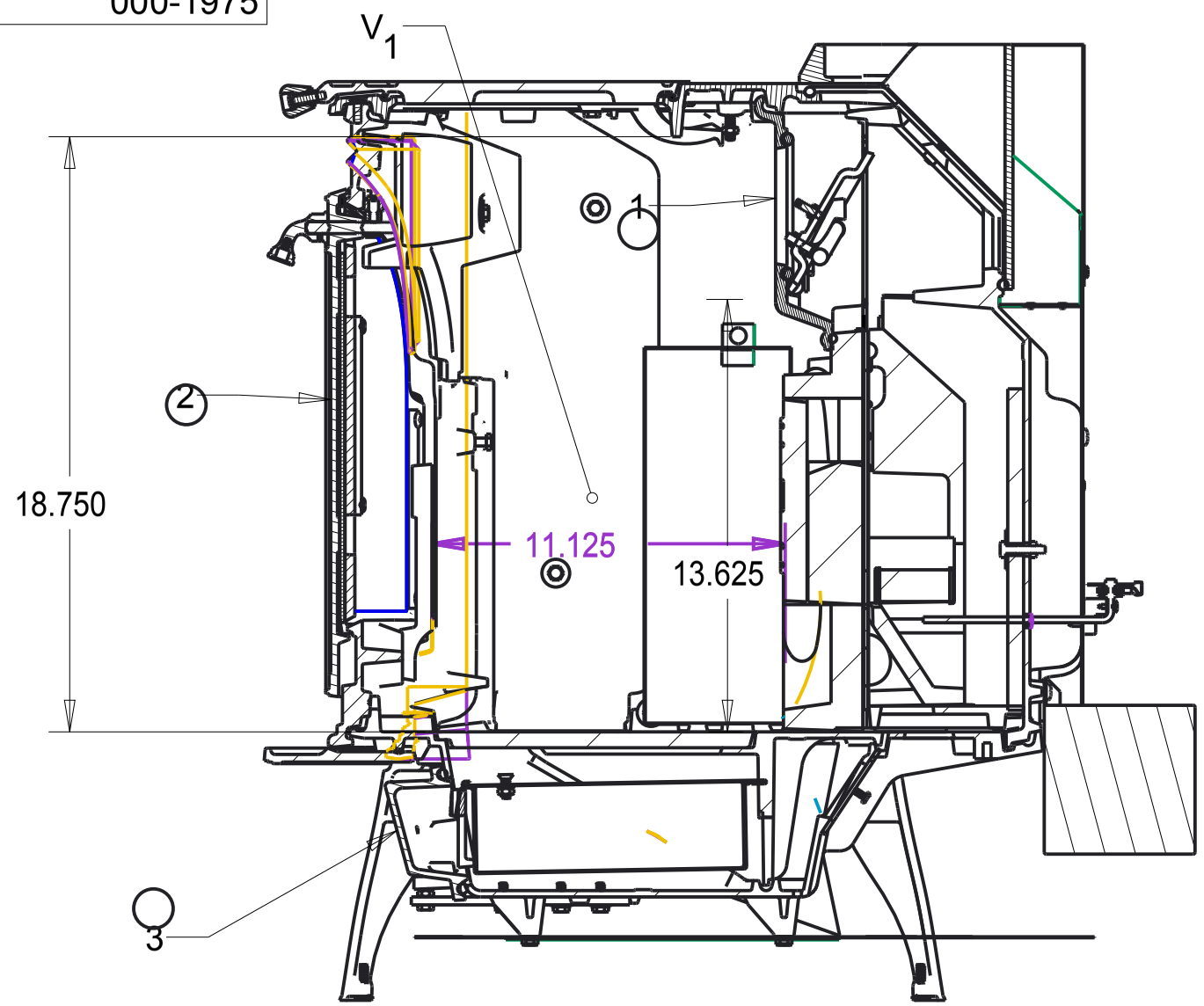
- **EXCEPT TO THE EXTENT PROVIDED BY LAW, HHT MAKES NO EXPRESS WARRANTIES OTHER THAN THE WARRANTY SPECIFIED HEREIN. The owner's exclusive remedy and HHT's sole obligation under this Warranty or in contract, tort or otherwise, shall be limited to replacement of the Component Part(s), repair of the Component Part(s), or refund of the original purchase price of the applicable Product(s), as specified above; provided, however, that (i) if HHT is unable to provide replacement of the Component Part(s) and repair of the Component Part(s) is not commercially practicable or cannot be timely made, or (ii) the customer is willing to accept a refund of the purchase price of the applicable Product(s), HHT may discharge all such obligations by refunding the purchase price of the applicable Product. In no event will HHT be liable for any incidental or consequential damages caused by defects in the applicable Product. Some States do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This Warranty gives you specific legal rights and you may also have other rights which vary from State to State. THE DURATION OF ANY IMPLIED WARRANTY IS LIMITED TO DURATION OF THE EXPRESSED WARRANTY SPECIFIED ABOVE FOR THE APPLICABLE PRODUCT. Some States do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.**

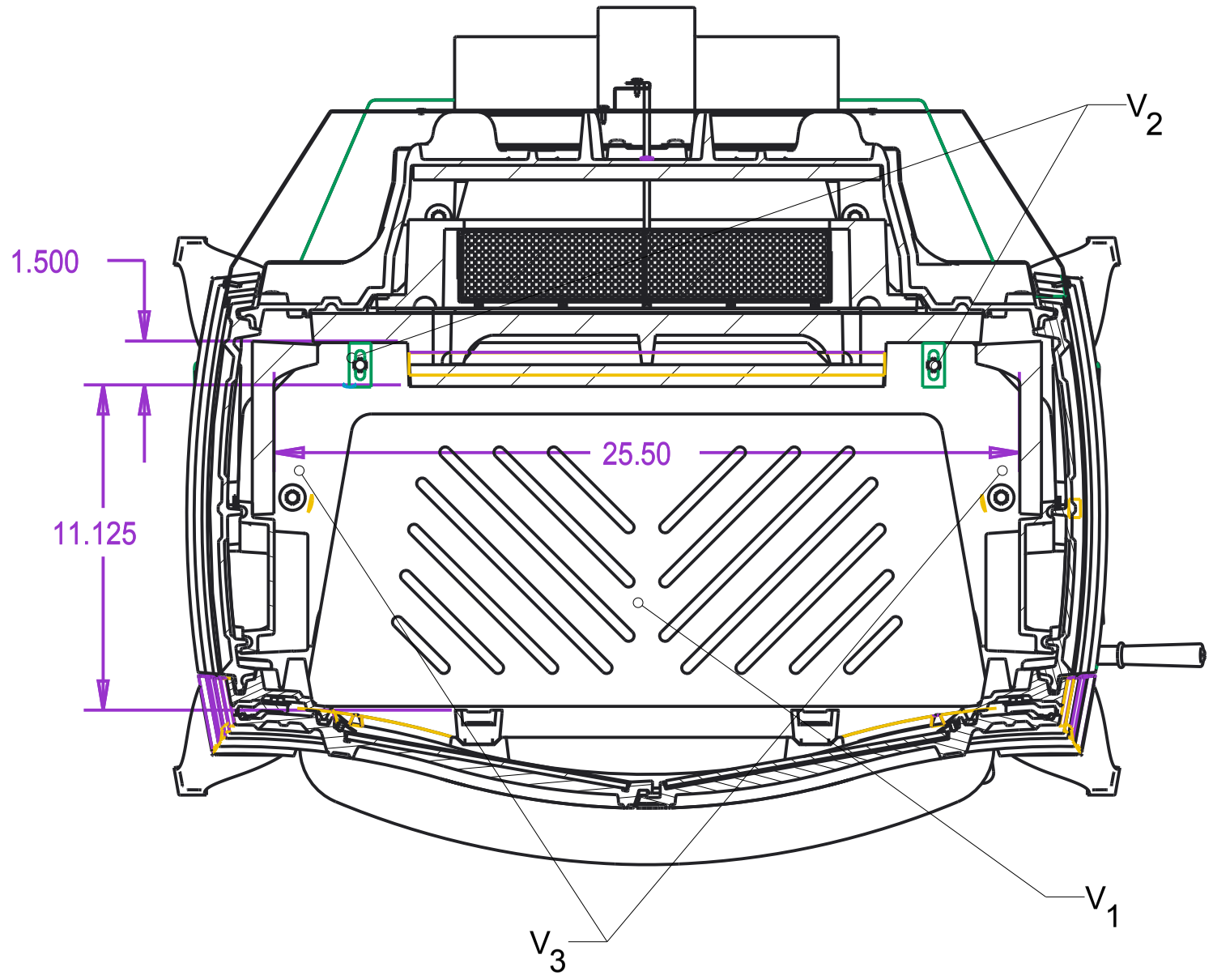
VERMONT CASTINGS™

352 Mountain House Road • Halifax, Pa 17032
www.vermontcastings.com

Appendix G – Firebox Volume Calculations

PART No: 000-1975





4

CERTIFICATION VOLUME CALCULATION:

V_1 = 11.125" X 25.5" X 18.75" = 0.927' X 2.125' X 1.5625' = 3.078 cu.ft.

V_2 = 1.5" X 4.92" X 13.625" = 0.125' X 0.41' X 1.135' = 0.058 cu.ft.

V_3 = ((0.5" X 11.125")/2) X 18.75" = ((0.042' X 0.927')/2) X 1.5625' = 0.030 cu.ft>

F.V. = V_1 + (V_2 X 2) + (V_3 x 2) = 3.078 ft^3 + 0.116 FT^3 + 0.060 ft^3 = 3.254 ft^3

F.V. = 3.25 FT

1. BYPASS OPENING:3-11/16 x 16-7/16, GASKET: 3.5ft 5/16 MEDIUM DENSITY FIBERGLASS.
2. DOOR OPENING 21-9/16 X 12-15/16, GASKET (2 DOORS): 7ft 7/16, LOW DENSITY
3. ASH DOOR GASKET: 4.5ft, 3/8" LOW DENSITY.
4. MIN SYSTEM AIR CROSS-SECTION, "AIR PLATE", 3-7/8" X 1-1/8"
   OPENING CONTROLLED BY AIR FLAP, PRIMARY AIR
   RANGE: FULL OPEN (4.36 sq. in.), FULL CLOSED (0 sq. in.)

SHOWN WITH DEFIANT-CAT-C
OPTION INSTALLED

tolerance: dims ±0.25"

VERMONT CASTINGS

USED ON: 0001975

TOLERANCES UNLESS OTHERWISE SPECIFIED

LINEAR & DIAMETER	BEND RADIUS
x.x ± 0.039 in (1.0 mm)	0.397 mm + 0.025 mm - 0
x.xx ± 0.020 in (0.5 mm)	
x.xxx ± 0.004 in (0.1 mm)	0.0156 in + 0.001 in - 0

GD & T TO COMPLY WITH ANSI Y14.5-1994

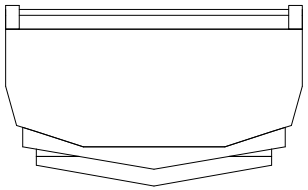
THIRD ANGLE PROJECTION: LEFT SIDE FRONT RIGHT SIDE

MATERIAL THICK: mm (in) MAX: mm (in) MIN: mm (in)			MATERIAL SPECIFICATION: (GA.)
DRAWN BY: VC	DATE: 08.07.18	SIZE: B	MATERIAL FINISH:
DESCRIPTION: DEFIANT FlexBurn C			SHEETS: 2 of 3
ECN No:	REV No: A	PART No: 000-1975	

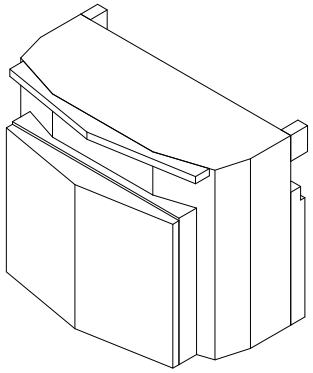
BOM: DEFIANT_FB_VOLUME

Pos	Qty	Part Name	Description	CUBIC FT
10	1	1 REGION	MAIN_FB	2.889
20	1	2 REGION	ANDIRON_TO_GLASS	.286
30	1	3 REGION	BACK_HOLES	.131
40	2	4 REGION	BACK_TOP	.003/.006
50	1	5 REGION	FRONT_TOP	.012

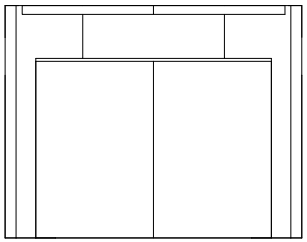
TOTAL CUBIC FT = 3.324



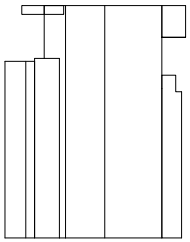
TOP



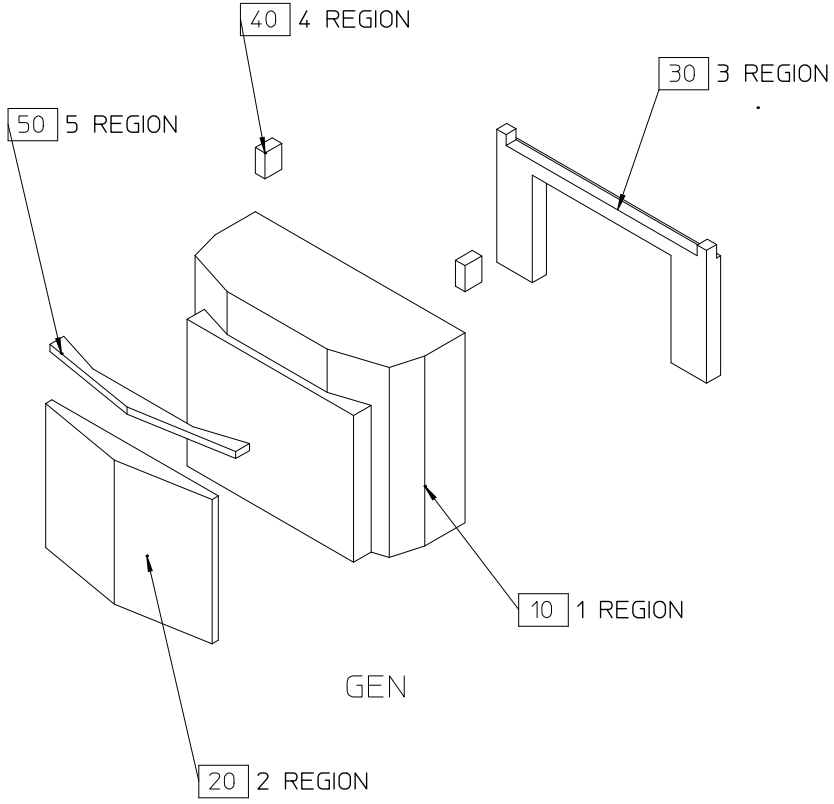
ISO



FRONT



RIGHT



GEN

TOTAL CUBIC FT = 3.324

242

REV	ECO#	REVISION NOTES	DATE	NAME

UNLESS OTHERWISE SPECIFIED: TOLERANCE - (2) PLACE DEC ±0.03 (3) PLACE DEC: ±0.005 ANGLE: ±2° FRACTION: ±1/16
OUTSIDE MATERIAL. NORMAL DIM & INSIDE MATERIAL. OUTSIDE APEX. INSIDE APEX - DIMS ENCLOSED BY AN OVAL ARE CRITICAL DIMENSIONS

HHT-HFX

HEARTH&HOME technologies

PART NAME: DEFIANT TOTAL FIREBOX VOLUME 000-1975

DRAWN BY:	DATE:	SCALE:	MATERIAL / FINISH:
Jerry Frantz	9/20/23 12:46 PM	1:10	

THIS PRINT IS CHECKED AND CONTROLLED BY THE ENGINEERING DEPARTMENTS OF HEARTH & HOME TECHNOLOGIES INC.

SHEET: 1 of 6

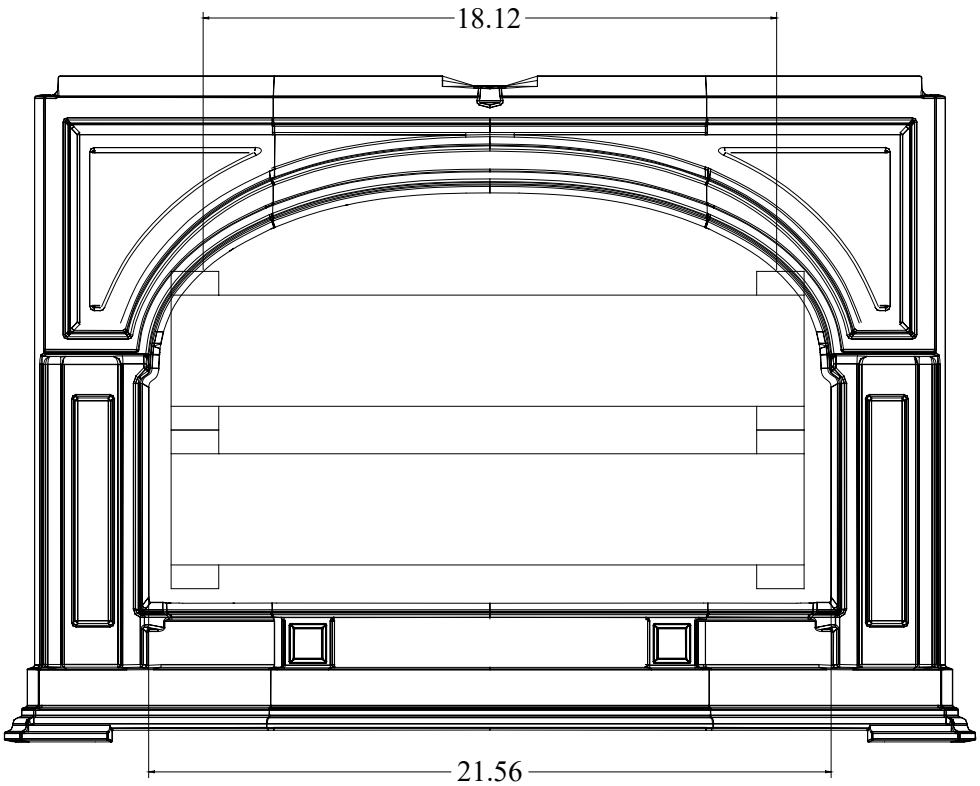
PART NUMBER: DEFIANT_FB_VOLUME

REV: E1.1

Appendix – H

Discussion regarding fuel load length

The firebox length of the Defiant 1975-CAT-C is the width (left to right) dimension which is a constant of 25.5 inches. 5/6 of 25.5 = 21.25 inches and the pieces used for testing were 20 inches in length. ASTM E2780, Clause 9.4.1.6 requires that each test fuel piece closely approximate 5/6 the dimension of the firebox length. The EPA has historically quantified this approximation to be ± 1 inch as noted on their checklist dated April 14, 2021. Therefore, the fuel pieces were 0.25 inches too short.

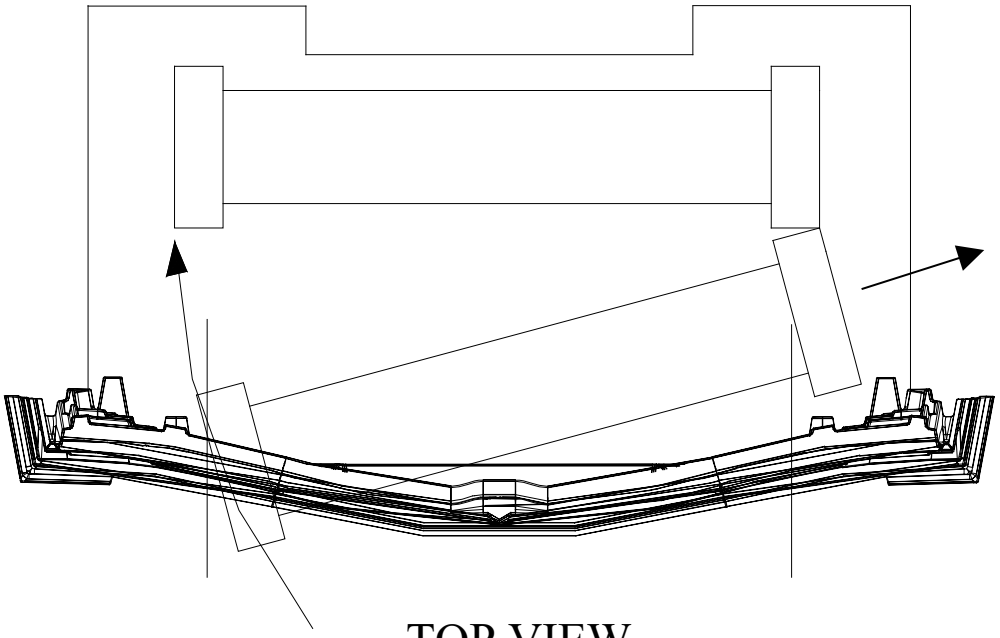


FRONT VIEW

Showing super-imposed representation of fuel charge (to scale)

The volume of the firebox is greater than 3.0 cubic feet and therefore required all pieces to be 4x4s. The fuel loading density requirement was such that 4 pieces of 4x4s were required. The fuel loading door opening features very large radii in the top corners whose curves extend downward nearly ½ of the over-all height of the opening. The widest portion of the opening is the bottom half region with a width of 21.56 inches. The width then reduces rapidly moving up and through the upper ½ of the opening. The effective width where the top of the fuel load

interferes with the radius is approximately 18.2 inches. This required that the top pieces of fuel be “shoehorned” into the fire chamber in an arcing maneuver to clear the interference the door opening. 20 inches proved to be the longest possible dimension that permitted loading with some degree of assurance of repeatability. The photographs in the report show how tightly the fuel load is bound by the top of the firebox opening.



TOP VIEW

Showing how one end needed to be deeply inserted (with limits of how deep due to interferences) to allow other end to arc into fire chamber avoiding the interfering door opening width (to scale).

Appendix I – Revision History

Date	Project No.	Tech. & Evaluator	Report Sect.	Summary of Changes
06/14/2019	0135WS043E	Bruce Davis	All	Original Report was Generated
05/04/2023	0135WS043E (Edition 001)	Riley Tiegs Ken Morgan	Appendix I	Appendix I created as “Revision History”
			Preface	Updated to new edition of report
			Section 1	Summary Tables now show “Corrected and Uncorrected” values with its definitions (pg 5)
			Section 2	Run narratives now include anomalies and their appropriateness. (pg9)
			Section 2.2	Appliance description explains the location of temperature sensor for the combustor catalyst (pg 11)
			Appendix F	New Manual added to report
			Appendix A	Added dilution tunnel Schematic (pg20)
				Wood heater test results updated to show Train Precision (pg 23,39,53,69,85,99)
				Wood Heater Test results with Uncorrected values added to test report (pg 40,54)
09/20/2023	0135WS043E (Edition 002)	Riley Tiegs Ken Morgan	Appendix G	Total firebox volume drawing added (pg 210)
			Section 2	Run 1 Anomalies addressed, background sampling anomalies addressed on all Run Summaries. (pg 9)
07/02/2024	0135WS043E (Edition 003)	Riley Tiegs Ken Morgan	Section 1	Corrected/Uncorrected definitions error fixed, minor verbiage correction. (pg5, pg40,54).
			Appendix E	Added additional conditioning data to test report, which includes fuel moisture and burn rate, (pg 158)
7/23/2024	0135WS043E ()Edition 004)	Ken Morgan	Appendix H Page 243	Added discussion regarding test fuel length.
			Appendix I	“Appendix H – Revision History” Renamed to :Appendix I – Revision History”