EPA Certification Test Report

The following models are EPA certified under the following attached test report:	**F3500**
	Model #
Wood Stoves	F3500
Wood Inserts	N/A
Wood Fireplaces	N/A
Pellet Stoves	N/A
Pellet Inserts	N/A

Full US Environmental Protection Agency ("EPA") certification test reports have been reported to the EPA. Test reports may contain sensitive, confidential business information which has been specifically excluded and/or redacted from this publicly posted test report.

Published July 28, 2021
E&OE

Fireplace Products International, Ltd.

Project # 18-446
Model: F3500
Type: Catalytic Wood-Fired Room Heater
December 18, 2018
Revised: July 28, 2021

ASTM E3053 Standard Test Method for Determining Particulate Matter Emissions from Wood Heaters Using Cordwood Test Fuel (EPA ALT-125)

Contact: Mr. Dave Lal
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Revision Summary

Date: December 18, 2018 – Original Issue

Date: July 28, 2021 – The following revisions were made per request from EPA:

-The “Run Narrative” section was edited to discuss negative filter weights reported during test Run 2, see page 9.

-The Firebox volume was added to the Main Body of the test report, to ensure its inclusion in the Non-CBI copy of the test report, see page 12.

-The Owner’s Manual has been updated to include further instruction on fire starting procedures and proper operation at low burn settings, see Appendix B, manual page 23 (Page 178 of Non-CBI Report).

-The test burn instructions from the manufacturer to the laboratory were added to Appendix A, see page 25 of Non-CBI Report.

Contents

Affidavit

PFS-TECO was contracted by Fireplace Products International Ltd. (FPI) to provide testing services for the F3500 Catalytic Wood-Fired Room Heater per ASTM E3053, *Standard Test Method for Determining Particulate Matter Emissions from Wood Heaters Using Cordwood Test Fuel*, which was approved for use under EPA ALT-125. All testing and associated procedures were conducted at PFS-TECO's Portland Laboratory beginning on 12/10/2018 and ending on 12/12/2018. PFS-TECO's Portland Laboratory is located at 11785 SE Highway 212 – Suite 305, Clackamas, Oregon 97015. Testing procedures followed ASTM E3053 with the exception of caveats described in EPA ALT-125. Particulate sampling was performed per ASTM E2515, *Standard Test Method for Determination of Particulate Matter Emissions Collected by a Dilution Tunnel,* with the exception of caveats described in EPA ALT-125. A copy of EPA ALT-125 is included in Appendix A for reference, as required by the approval letter.

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

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

Sebastian Button, Laboratory Supervisor

Introduction

FPI-Regency Fireplaces Products of Delta, BC, contracted with PFS-TECO to perform EPA certification testing on F3500 Catalytic Wood-Fired Room Heater. All testing was performed at PFS-TECO's Portland Laboratory. Testing was performed by Mr. Sebastian Button.

Notes

- Prior to start of testing, 50 hours of conditioning was performed per ASTM E3053.
- Prior to start of testing, the dilution tunnel was cleaned with a steel brush.
- Front filters were changed on sample train A at one hour for all 3 test runs.
- A total of 3 test runs were performed in accordance with ASTM E3053, no anomalies occurred, no additional tests performed, see Run Narrative section for further detail on each run.

Wood Heater Identification and Testing

- Appliance Tested: ***F3500***
- Serial Number: ***431 001738 – PFS Tracking Number 0016***
- Manufacturer*:* ***FPI-Regency Fireplace Products***
- Catalyst: ***Yes***
- Heat exchange blower: ***Optional***
- Type: ***Wood Stove***
- Style: ***Free Standing***
- Date Received: ***Thursday, December 06, 2018***
- Wood Heater Aging: ***November 5, 2018 - November 9, 2018***
- Testing Period – Start: ***Monday, December 10, 2018*** Finish: ***Wednesday, December 12, 2018***
- Test Location: ***PFS-TECO Portland Laboratory, 11785 SE HWY 212 - Suite 305, Clackamas, OR 97015***
- Elevation: ***≈131 Feet above sea level***
- Test Technician(s): ***Sebastian Button***
- Observers: ***Dave Lal of FPI.***

Test Procedures and Equipment

All Sampling and analytical procedures were performed by Sebastian Button. All procedures used are directly from ASTM E3053 and ASTM E2515. See the list below for equipment used. See Appendix C submitted with this report for calibration data.

Equipment List:

Equipment ID#	Equipment Description
041	Rice Lake 3'x3' floor scale w/digital weight indicator
050	Digiweigh DWP12i Platform Scale
053	APEX XC-60 Digital Emissions Sampling Box A
054	APEX XC-60 Digital Emissions Sampling Box B
055	APEX Ambient sampling box
057	California Analytical ZRE CO2/CO/O2 IR ANALYZER
064	Digital Barometer
109A/B	Troemner 100mg/200mg Audit Weights
107	Sartorius Analytical Balance
051	10 lb audit weight
090	Dewalt Tape Measure
092	Digital Calipers
095	Anemometer
111	Microtector
115	Delmhorst Wood Moisture Meter
CC700832	Gas Analyzer Calibration Span Gas
CC170624	Gas Analyzer Calibration Mid Gas

Results

The weighted average emissions rate for the 3 run test series was measured to be **0.9 g/hr** with a Higher Heating Value efficiency of **81.0%.** The average CO emission rate for the 3 tests was **0.39 g/min.** The FPI F3500 Catalytic Wood-Fired Room Heater meets the 2020 cordwood PM emission standard of ≤ 2.5 g/hr per CFR 40 part 60, §60.532 (c).

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

Summary Table

	High Fire Test	Low Fire Test	Medium Fire Test
Date	12/10/2018	12/11/2018	12/12/2018
Run Number	1	2	3
PM Emission Rate (g/hr)	2.74	0.21	0.69
Burn Rate (kg/hr)	3.39	0.67	1.39
Heat Output (BTU/hr)	36,174	10,704	20,844
HHV Efficiency (%)	77.9	84.1	79.4
LHV Efficiency (%)	83.3	89.9	84.9
CO Emissions (g/MJ output)	0.13	0.93	2.05
CO Emissions (g/kg dry fuel)	2.10	15.63	32.55
CO Emissions (g/min)	0.09	0.18	0.75
First Hour Emission Rate (g/hr)	4.88	1.93	2.92
Weighting Factor (%)	20	40	40
Weighted particulate emission average of 3 test runs: 0.9 grams per hour.			
Weighted average HHV efficiency of 3 test runs: 81.0%.			
Average CO emission rate for 3 test runs: 0.39 grams per minute			

Test Run Narrative

Run 1

Run 1 was performed on 12/10/2018 as a high fire test run per ASTM E3053. Emissions sampling began from a cold start ignition of kindling and start-up fuel. The test fuel load was loaded 36 minutes into the test. Testing was completed when 90% of the test fuel load was consumed. Total test time was 209 minutes, main test fuel load burn time was 173 min. The particulate emissions rate from kindling ignition to test completion was 2.74 g/hr. The burn rate of the test fuel load was 3.39 kg/hr. The main test load portion of the run had an overall HHV efficiency of 77.9%. The train A front filter was changed at 1 hr. All test results were appropriate and valid. There were no anomalies and all test criteria were met.

Run 2

Run 2 was performed on 12/11/2018 as a low fire test run per ASTM E3053. The overall test duration was 1140 minutes. The burn rate for the test run was 0.67 kg/hr. The particulate emissions rate for the test run was 0.21 g/hr. The run had an overall HHV efficiency of 84.1%. The train A front filter was changed at 1 hr.

Upon completion of testing, lab analysis of the sample filters for the Train A post 1st hour samples yielded a negative number (-0.6 mg). This was the result of a portion of the filter attaching to O-ring seal and pulling away from the filter. This is reflected in the weight of the catch on the O-rings for this given run (2.1 mg) which is significantly larger than typical O-ring catch amounts which are usually less than 0.3 mg. While this type of result is infrequent with Teflon filters, it is with this type of occurrence in mind that O-rings are also included in the test analysis. The negative values report during this run should be considered valid and appropriately handled. All other test results were appropriate and valid. There were no other anomalies and all test criteria were met.

Run 3

Run 3 was performed on 12/12/2018 as a medium fire test run per ASTM E3053. The overall test duration was 565 minutes. The burn rate for the test run was 1.39 kg/hr, therefore the medium fire category requirements were met, less than the mid-point of the high and low burn rates (2.03 kg/hr). The particulate emissions rate for the test run was 0.69 g/hr. The run had an overall HHV efficiency of 79.4%. The train A front filter was changed at 1 hr. There were no anomalies and all criteria were met.

Test Conditions Summary

Testing conditions for all runs fell within allowable specifications of ASTM E3053 and ASTM E2515. A summary of facility conditions, fuel burned, and run times is listed below.

Runs	Ambient (°F)		Relative Humidity (%)		Average Barometric Pressure (In. Hg.)	Preburn Fuel Weight (lbs)	Test Fuel Weight (lbs)	Test Fuel Moisture (%DB)	Test Run Time (Min)
	Pre	Post	Pre	Post					
1	62	71	33.7	29.2	30.20	10.9[1]	29.74	22.6	209[2]
2	75	69	31.3	24.6	29.98	29.96	35.30	23.2	1140
3	75	73	26.2	23.7	30.14	31.17	35.06	21.3	565

[1]This is the weight of the kindling and startup fuel

[2]Total test time was 209 min, high fire test load burn duration was 173 min.

Appliance Operation and Test Settings

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

Settings & Run Notes

	Pre-Burn Air Setting	Test Run Air and Fan Settings
Run 1	N/A – Cold Start Ignition	Air control set to high fire test setting (2.688” open from fully closed), blower off for first 20 min, then set to high.
Run 2	Air control set to High Fire Setting in accordance with ASTM E3053	Air control set to low fire test setting (fully closed), blower off for first 20 min, then set to low.
Run 3	Air control set to High Fire Setting in accordance with ASTM E3053	Air control set to medium fire test setting (1.547” open from fully closed), blower off for first 20 min, then set to low.

Appliance Description

Model(s): F3500

Additional Models Discussion: None

Appliance Type: Catalytic Wood-Fired Room Heater

Firebox Volume: 3.04 ft^3

Air Introduction System: Primary Air enters the firebox from the front bottom of the appliance and is channeled up the sides on the appliance and down through the air wash, as well as through a pilot air opening in the front of the firebox. Primary air is controlled via a damper arm located below the ashlip which moves left (open) to right (closed). Secondary air is pulled through a fixed opening in to rear bottom of the appliance and channeled up through a single secondary air tube. Dimensions on all these features can be found in Appendix D.

Bypass: The combustor bypass plate is located at the top/rear of the firebox and is operated via a control arm on the left side of the stove. When engaged, flue gases are forced to the front of the firebox and up through the combustor. When open, the flue gases exhaust straight up the flue through a 10.25" x 4.25" opening.

Flue Outlet: 6-inch exhaust outlet located on the top of the appliance.

Catalytic Combustor: 2, 3.5" x 7" x 3" 16 cell ceramic substrate Applied Ceramics combustors are located at the top of the firebox, above the secondary tubes. A catalyst temperature probe is provided with the appliance to monitor exit temperatures within 1" of the combustor.

Fan: The F3500 is optionally offered with a convection fan that attached to the bottom rear of the appliance.

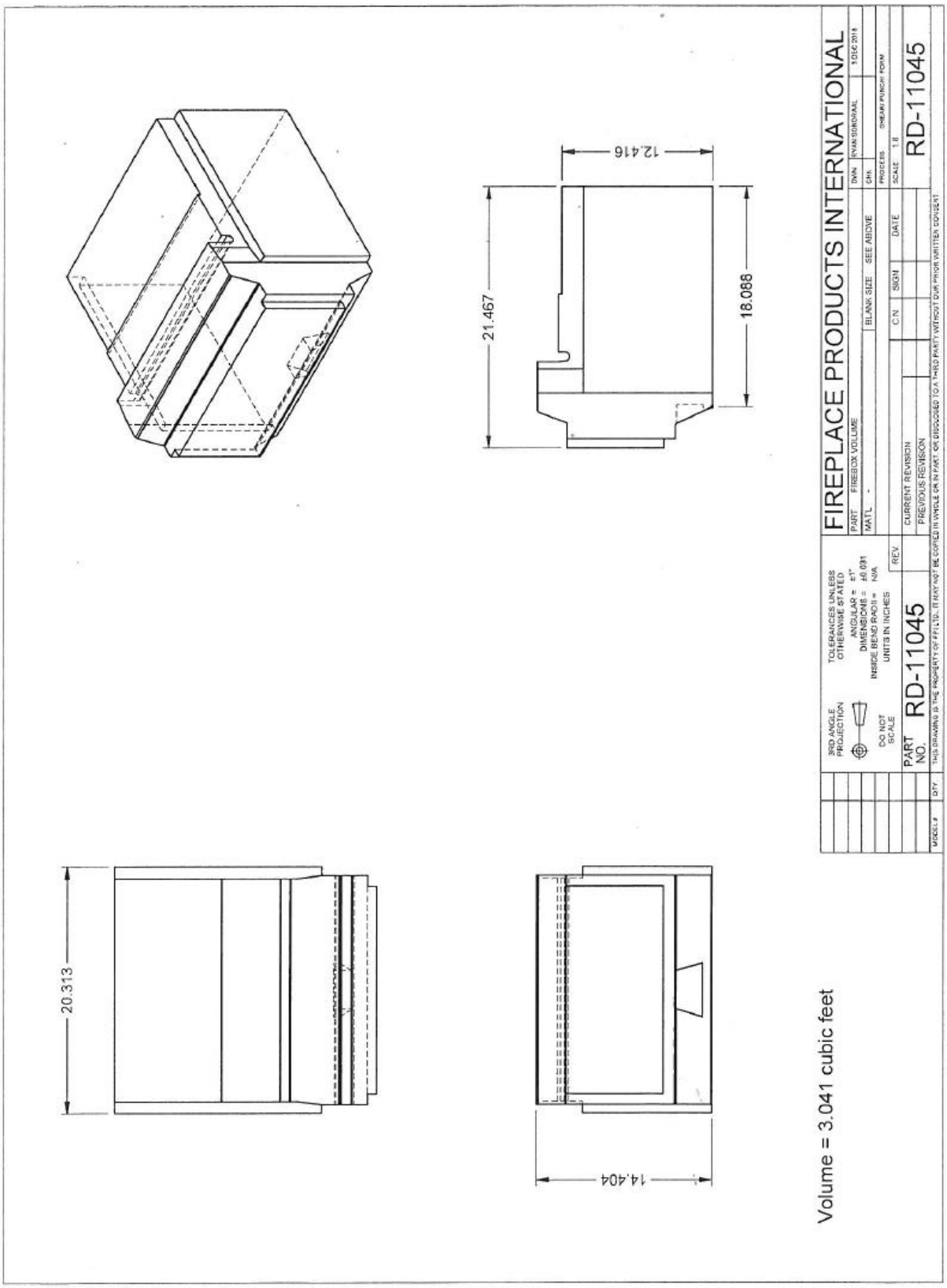
Appliance Dimensions

F3500 Unit Dimensions

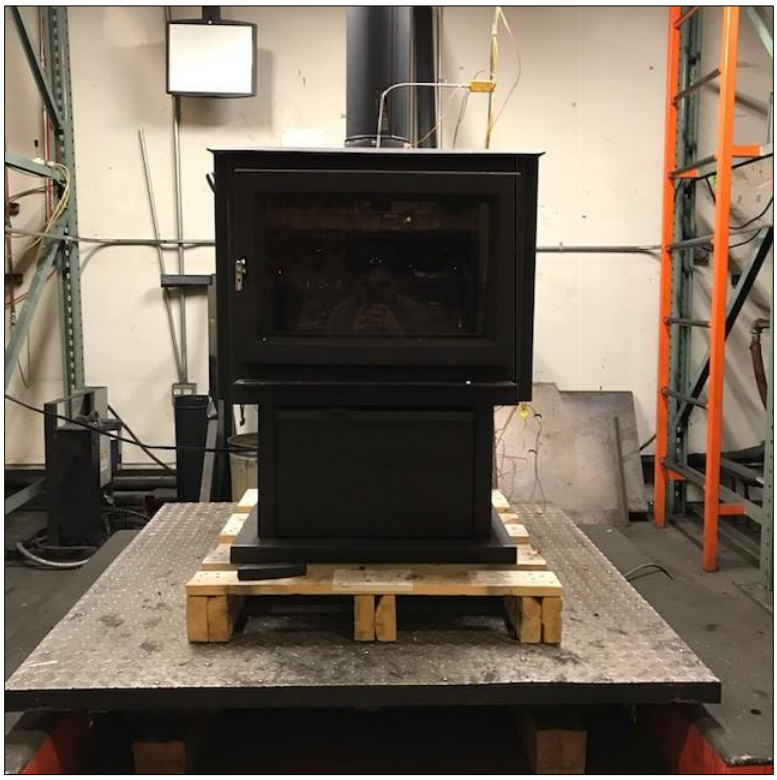
Height	Width	Depth	Firebox Volume
36.0"	26.0"	24.5"	3.04 ft^3

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

Firebox Volume



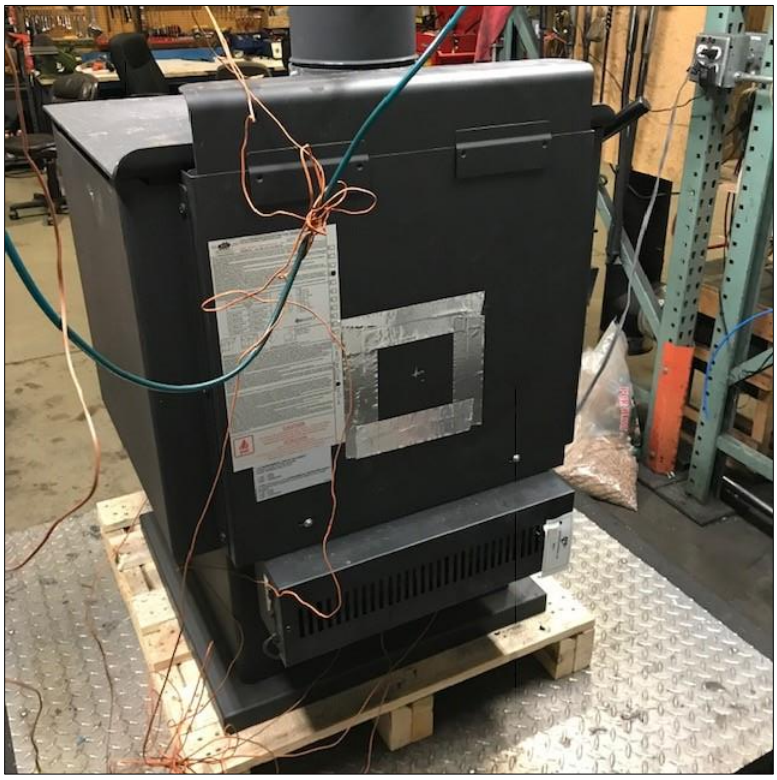
Appliance Front



Appliance Left

Appliance Right

Appliance Rear



Test Fuel Properties

Test fuel used was Maple cordwood, split and air-dried to the specified moisture content range. Typical fuel loads are pictured below:

Typical Kindling Load

Typical Startup Load

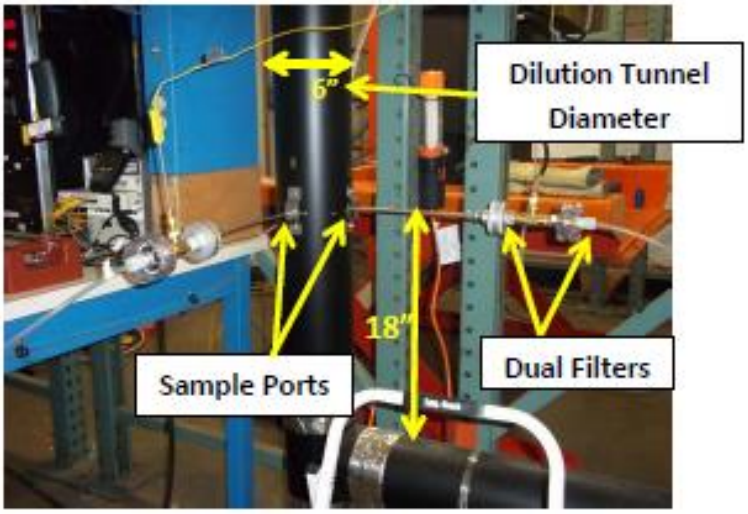
Typical High Fire Load

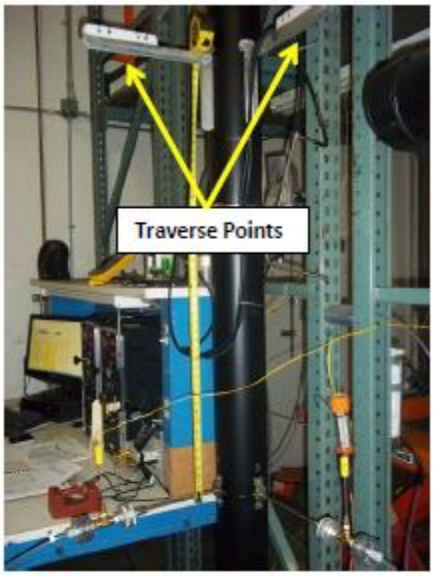
Typical Low Fire Load

Sampling Locations and Descriptions

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

Sample Points





Sampling Methods

ASTM E2515 was used in collecting particulate samples. The dilution tunnel is 6 inches in diameter. All sampling conditions per ASTM E2515 were followed. No alternate procedures were used with the exception of caveats described in ALT-125: Pall TX40 Emfab filters were used, filter temperatures were maintained between 80 and 90°F for all tests, filters were weighed in pairs where applicable, and no sampling intervals fell outside of proportional rates of +/- 10%.

Analytical Methods Description

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

Calibration, Quality Control and Assurances

Calibration procedures and results were conducted per EPA Method 28R, ASTM E2515-11 and ASTM E3053. Test method quality control procedures (leak checks, volume meter checks, stratification checks, proportionality results) followed the procedures outlined.

Appliance Sealing and Storage

Upon completion of testing, the appliance was secured with metal strapping and the seal below was applied, the appliance was then returned to the manufacturer's location at: 6988 Venture St, Delta, BC V4G 1H4, Canada, for archival.

Sealing Label

ATTENTION:

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

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

REPORT #_____ DATE SEALED_____

MANUFACTURER_____ MODEL #_____

Sealed Unit

List of Appendices

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

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

Appendix B – Labels and Manuals

Appendix C –Equipment Calibration Records

Appendix D – Design Drawings (CBI Report Only)

Appendix E – Manufacturer QAP (CBI Report Only)

WOOD HEATER TESTING SUMMARY

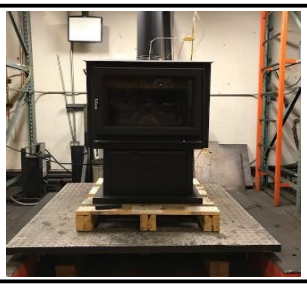
SECTION 1 – Model Identification

Model Name(s)/Number(s)	F3500
Manufacturer	FPI - Regency Fireplaces Products
Address 1	6988 Venture St.
Address 2	Delta, BC V4G 1H4
Appliance Category(s) (Free-standing, Insert, etc.)	Freestanding Woodstove
Usable Firebox Volume - ft^3	3.04
Catalytic/Non-Cat	Catalytic
Convection Air Fan (No, Standard, Optional)	Optional

SECTION 1B – Laboratory Information

Testing Laboratory	PFS-TECO
Address 1	11785 SE Hwy 212 Ste 305
Address 2	Clackamas, OR 97015
ISO/Accreditation Info	ISO 17025
Dates Tested	12/10/2018 - 12/12/2018
Test Methods/Standards	ASTM E3053 (ALT-125), ASTM E2515
Dilution Tunnel Inside Diameter - in.	6.00
Fliter Diameter - mm	47
Filter Material	Pall Type TX40

Test Configuration Photographs



Stove Front

Stove Left

Stove Right

Typical Kindling Load

Typical Start-up Load

Typical High Fire Load

Typical High Fire Coal Bed

Typical Low/Med Fire Load

Typical Low Fire Coal Bed

SECTION 2 – Test Conditions Summary

Model Name(s)/Number(s)	F3500			
Usable Firebox Volume - ft^3	3.04			
Convection Air Fan (No, Standard, Optional)	Optional			
Test Run #	1	2	3	
Date Tested	12/10/2018	12/11/2018	12/12/2018	
Test Run Category (L, M, H)	H	L	M	
Average Barometric Pressure - in Hg	30.20	29.98	30.14	
Max. Observed Ambient Temp - °F	72	75	78	
Min. Observed Ambient Temp - °F	62	68	73	
Max. Observed Filter Temp - °F	87	86	87	
Test Run Air Settings				
Primary (measured up from minimum)	Maximum	Minimum	1.547"	
Secondary (measured up from minimum)	Fixed	Fixed	Fixed	
Convection Air Fan Setting	High	Low	Low	
Test Fuel Load				
Cordwood Fuel Species	Maple	Maple	Maple	
Specific Gravity (from Table 1)	0.6	0.6	0.6	
Higher Heating Value - Btu/lb (from Annex A1)	8587	8587	8587	
Nom. Test Fuel Load Piece Length - in.	17	17	17	
Number of Test Fuel Pieces	6	6	6	
Test Fuel Weight				
Kindling - As Fired lb	4.45	na	na	
Kindling Wt. - As % of Test Fuel Load	15%	na	na	
Kindling Moisture - % DB	10%	na	na	
Kindling - kg DB	1.83	na	na	
SU Fuel - As Fired lb	6.44	na	na	
SU Fuel Wt. - As % of Test Fuel Load	22%	na	na	
SU Fuel Moisture - % DB	22%	na	na	
SU Fuel - kg DB	2.39	na	na	
Test Fuel Load - As Fired lb	29.74	35.3	35.06	
Ave. Test Fuel Load MC % DB	22.6%	23.2%	21.3%	
Test Fuel Load - kg DB	11.00	13.02	13.13	
Test Fuel Loading Density - lb/ft^3	9.78	11.61	11.53	
Residual SU Fuel Wt. - As Fired lb	3.30	na	na	
Residual SU Fuel Wt. - As % of Test Fuel Load	11%	na	na	
Test Run Duration - minutes	209	1140	565	
Test Run Duration - h	3.48	19.00	9.42	
Run Duration of High Fire Load Only - minutes	173	na	na	
Run Duration of High Fire Load Only - h	2.88	na	na	
Test Fuel Load Wt. at End of Test - As Fired lb	2.7	0.5	0	
Total Total Fuel Burned - kg DB	12.49	12.80	13.13	
% Test Fuel Load Wt. at End of Test	9.1%	1.4%	0.0%	

SECTION 3 – Test Run Results Summary

Model Name(s)/Number(s)	F3500			
Usable Firebox Volume - ft^3	3.04			
Convection Air Fan (No, Standard, Optional)	Optional			
Test Run #	1	2	3	
Date Tested	12/10/18	12/11/18	12/12/18	
Test Run Category	H	L	M	
Burn Rate - kg/h DB	3.39	0.67	1.39	
Burn Rate - As % of Low to High Midpoint	na	na	69%	
Burn Duration - h	3.48	19.00	9.42	
Heat Output - Btu/h	36174	10704	20844	
Average Dilution Tunnel Flow Rate - dscfm	157.80	153.90	151.00	
Average Sample Flow Rates - dscfm				
Train 1	0.147	0.151	0.145	
Train 2	0.145	0.149	0.148	
Total PM Emissions - g				
Train 1	9.38	4.07	6.65	
Train 2	9.68	3.81	6.33	
Average	9.530	3.940	6.490	
PM Emission Train Precision - %	-1.6%	3.3%	2.5%	
PM Emission Train Precision - g/kg	-0.02	0.02	0.02	
PM Emission Rate - g/h	2.74	0.21	0.69	
Total CO Emissions - g	15	200	425	
CO Emissions Rate - g/h	5	11	45	
Overall Efficiency - CSA B415.1-10				
% HHV Basis	77.9	84.1	79.4	
% LHV Basis	83.3	89.9	84.9	

SECTION 4 - Weighted Average Summary

Model Name(s)/Number(s)	F3500		
Usable Firebox Volume - ft_3	3.04		
Convection Air Fan (No, Standard, Optional)	Optional		
Average for Each Test Run Category	L	M	H
Burn Rate - kg/h DB	0.67	1.39	3.39
PM Emission Rate - g/h	0.21	0.69	2.74
CO Emissions Rate - g/h	10.5	45.1	5.2
Overall Efficiency - CSA B415.1-10			
% HHV Basis	84.1	79.4	77.9
% LHV Basis	89.9	84.9	83.3
Heat Output - Btu/h	10700	20800	36200
Category Weighting	40%	40%	20%

ASTM E 3053 Weighted Averages			
PM Emission Rate - g/h	0.9		
CO Emissions Rate - g/h	23		
Overall Efficiency - CSA B415.1-10			
% HHV Basis	81		
% LHV Basis	87		
Heat Output Range - Btu/h	10700	to	36200

Conditioning Data

Client:	FPI	Job #:	18-446
Model:	F3500	Tracking #:	0016
Date(s):	11/5/2018 - 11/9/2018	Technician:	SJB

		Average:	285.4	68.2	819
Elapsed Time (hrs)	Scale Reading (lbs)	Weight Change (lbs)	Flue (°F)	Ambient (°F)	Catalyst Exit (°F)
0	11.5	-	413	63	932
1	4.6	-6.9	297	64	962
2	11.0	6.4	304	65	963
3	9.8	-1.2	310	66	961
4	8.2	-1.6	248	66	913
5	10.6	2.4	358	67	923
6	6.7	-3.9	255	69	781
7	7.0	0.3	339	68	893
8	4.6	-2.4	287	68	745
9	4.4	-0.2	310	68	859
10	16.8	12.4	333	71	128
11	10.0	-6.8	338	70	1030
12	7.5	-2.5	242	70	713
13	6.3	-1.2	211	69	616
14	5.1	-1.2	211	67	614
15	3.9	-1.2	213	67	603
16	2.9	-1.0	206	67	567
17	35.8	32.9	408	71	873
18	29.7	-6.1	290	72	878
19	23.4	-6.3	315	71	1000
20	17.2	-6.2	318	73	1017
21	12.1	-5.1	326	73	1087
22	7.8	-4.3	293	72	921
23	5.7	-2.1	248	72	791
24	4.3	-1.4	202	71	608
25	3.2	-1.1	200	71	613
26	1.9	-1.3	207	70	611
27	0.9	-1.0	199	70	591
28	35.5	34.6	398	70	831
29	28.9	-6.6	285	71	869
30	23.5	-5.4	304	70	930
31	18.4	-5.1	307	70	922
32	14.4	-4.0	293	69	920
33	9.4	-5.0	317	69	989
34	6.5	-2.9	254	69	775
35	4.5	-2.0	231	68	678
36	3.1	-1.4	219	68	648
37	1.8	-1.3	212	68	629
38	0.6	-1.2	206	67	604
39	11.7	11.1	416	61	972
40	6.3	-5.4	324	62	1006
41	11.7	5.4	359	65	1026
42	10.3	-1.4	291	65	904
43	6.7	-3.6	246	66	771
44	6.8	0.1	268	67	823
45	6.0	-0.8	306	66	753
46	26.9	20.9	320	66	962
47	18.7	-8.2	325	69	1020
48	13.7	-5.0	287	69	918
49	10.3	-3.4	265	67	839
50	7.5	-2.8	242	66	789

Signature/Date:  12/10/2018

Emission testing instructions F3500

Volume: 3.04 cu.ft.

Low and Medium

High before Low and Medium – no sampling. Air set to High Setting

Fan on high at 20 min after loading main fuel load

Kindling – 4.5lb

Startup fuel – 6.5lb

Procedure

Start with a couple pieces of crumbled paper in between and 2.5 lbs kindling. Adjust the door opening for less smoke and establish a good fire. Keep the door open in that position for 3 – 4 min.

Closed bypass after 3-4 minutes if fire is well established.

At 1lb load the remainder of the kindling fuel, close door soon after loading to keep the catalyst from cooling down.

At 2b load 3.5lb SU fuel, load center back and close the door right away after loading. Put smaller pieces and leave the bigger ones for the next load.

At 4lb level the burning wood and load the remaining of SU fuel more to the back. Close the door immediately after loading, and load quickly.

At low end of coal bed range load the high load. Close the door right away.

At 20 min turn on the fan on high.

Around 7-9lbs adjust the load. Lift the unburned pieces out from the coals and bring unburned pieces to center front to ensure full charcoalization.

Around 4.5-5.5 lbs, when everything is burned, and almost no flames left rake the coals, zero the scale and follow the standard loading procedure.

Low and Medium test load

Load heavier logs to the sides.

Keep the door open a couple seconds so there is a strong fire going.

Air adjustment

Medium

At 15 min set the air to medium air setting.

Fan on low at 20 min

Low

At 15 min set to Low setting.

Fan on low at 20 min.

WOOD STOVE TEST DATA PACKET
ASTM E3053/E2515

Run 1 Data Summary

Client: FPI
Model: F3500
Job #: 18-446
Tracking #: 0016
Test Date: 12/10/2018

12/13/2018

Techician Signature Date

TEST RESULTS - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

Burn Rate (kg/hr):	3.39

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft^3)	27.087	30.780	30.307	8.683
Average Gas Velocity in Dilution Tunnel (ft/sec)	14.68			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	9469.5			
Average Gas Meter Temperature (°F)	67.8	86.5	85.7	74.1
Total Sample Volume (dscf)	27.313	30.227	29.657	8.724
Average Tunnel Temperature (°F)	112.0			
Total Time of Test (min)	209			
Total Particulate Catch (mg)	0.0	8.6	8.7	4.5
Particulate Concentration, dry-standard (g/dscf)	0.0000000	0.0002845	0.0002934	0.0005158
Total PM Emissions (g)	0.00	9.38	9.68	4.88
Particulate Emission Rate (g/hr)	0.00	2.69	2.78	4.88
Emissions Factor (g/kg)	-	0.75	0.77	-
Difference from Average Total Particulate Emissions (g)	-	0.15	0.15	-
Difference from Average Emissions Factor (g/kg)	-	0.01	0.01	-

Final Average Results	
Total Particulate Emissions (g)	9.53
Particulate Emission Rate (g/hr)	2.74
Emissions Factor (g/kg)	0.76
HHV Efficiency (%)	77.9%
LHV Efficiency (%)	83.3%
CO Emissions (g/min)	0.09

Quality Checks	Requirement	Observed	Result
Dual Train Precision	Each train within 7.5% of average emissions (in grams), or emission factors within 0.5 g/kg	See Above	OK
Filter Temps	>80 °F, <90 °F	Min: 81 / Max: 87	OK
Face Velocity	< 30 ft/min	8.6	OK
Leakage Rate	Less than 4% of average sample rate	0 cfm	OK
Ambient Temp	55-90 °F	Min: 62 / Max: 72	OK
Negative Probe Weight Evaluation	<5% of Total Catch	Probe Catch Not Negative	OK
Pro-Rate Variation	90% of readings between 90-110%; none greater than 120% or less than 80%	See Data Tabs	OK

B415.1 Efficiency Results

Manufacturer:	FPI
Model:	F3500
Date:	12/10/18
Run:	1
Control #:	18-446
Test Duration:	173
Output Category:	High

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	77.9%	83.3%
Combustion Efficiency	99.5%	99.5%
Heat Transfer Efficiency	78.3%	83.8%

Output Rate (kJ/h)	38,134	36,174	**(Btu/h)**
Burn Rate (kg/h)	2.45	5.40	**(lb/h)**
Input (kJ/h)	48,943	46,428	**(Btu/h)**

Test Load Weight (dry kg)	7.07	15.58	**dry lb**
MC wet (%)	18.42		
MC dry (%)	22.57		
Particulate (g)	9.53		
CO (g)	15		
Test Duration (h)	2.88		

Emissions	**Particulate**	**CO**
g/MJ Output	0.09	0.13
g/kg Dry Fuel	1.35	2.10
g/h	3.31	5.14
g/min	0.06	0.09
lb/MM Btu Output	0.20	0.31

Air/Fuel Ratio (A/F)	7.63

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

HIGH FIRE FUEL LOAD DATA - ASTM E3053

Client: FPI
Job #: 18-446
Model: F3500
Tracking #: 0016
Run #: 1
Technician: SJB
Date: 12/10/2018

Nominal Loading Density (lbs/ft^3, wet basis):	10		
Usable Firebox Volume (ft^3):	3.04		
Target Load Weight (lbs):	30.40		
Total Load Weight Range (lbs):	28.90	to	31.90
Core Load Weight Range (lbs):	13.70	to	19.80
Remainder Load Weight Range (lbs):	10.60	to	16.70
Core Load Piece Range (lbs):	4.60	to	7.60
Remainder Load Piece Range (lbs):	3.00	to	16.70
Max Allowable Kindling Weight (lbs):	5.95		
Max Allowable Start-up Fuel Weight (lbs):	8.92		

CORE LOAD DATA

				Fuel Piece Moisture Readings (%DB)					Dry Weight	
Piece #	Length (in)	Weight (lbs)	Within Spec?	1	2	3	Ave.	Within Spec?	lbs	kg
1	17	4.92	In Range	22.9	19.2	23.9	22.0	In Range	4.03	1.83
2	17	4.89	In Range	23.4	24.0	19.0	22.1	In Range	4.00	1.82
3	17	5.14	In Range	20.9	22.9	22.9	22.2	In Range	4.21	1.91
Core Load Wt. (lbs)		14.95	In Range							

REMAINDER LOAD DATA (1 to 3 Pieces)

				Fuel Piece Moisture Readings (%DB)					Dry Weight	
Piece #	Length (in)	Weight (lbs)	Within Spec?	1	2	3	Ave.	Within Spec?	lbs	kg
1	17	4.23	In Range	25.0	20.0	25.0	23.3	In Range	3.43	1.56
2	17	4.45	In Range	24.3	22.7	18.0	21.7	In Range	3.66	1.66
3	17	6.11	In Range	23.6	23.9	24.0	23.8	In Range	4.93	2.24
Remainder Load (lbs)		14.79	In Range							

Total Load Weight (lbs):	29.74	In Range	
Core Load % of Total Weight:	50%	In Range	45-65%
Remainder % of Total Weight:	50%	In Range	35-55%
Total Load % of Target Weight:	98%	In Range	95-105%
Actual Fuel Loading Density (lb/ft3):	9.8		
Total Load Average Moisture Conent (%DB):	22.6	In Range	19-25%
Total Load Average Moisture Conent (%WB):	18.4		
Total Test Load Weight (dry basis):	24.26 lbs	11.01 kg	

KINDLING AND START-UP FUEL

		Kindling Moisture Readings (%DB)					Dry Weight	
Kindling Weight (lbs)	Within Spec?	1	2	3	Avg.	Within Spec?	lbs	kg
4.45	In Range	10	10	10	10.0	In Range	4.05	1.84

		Start-up Moisture Readings (%DB)					Dry Weight	
Start-up Fuel Wt. (lb)	Within Spec?	1	2	3	Avg.	Within Spec?	lbs	kg
6.44	In Range	21.4	20.9	23.4	21.9	In Range	5.28	2.40

TEST FUEL LOADING RANGE

Allowable Residual Start-up Fuel Range (lb):	3.0	to	5.9	
Actual Residual Start-up Fuel Weight (lb):	3.3			In Range

TEST END POINT

High Fire Test Run End Point Range:	2.7	to	3.3	lb
Actual Fuel Load Ending Weight (lb):	2.7			In Range

Total Weight All Fuel Added: 40.63 lbs, wet basis
33.59 lbs, dry basis
15.24 kg, dry basis

Total Weight All Fuel Burned (dry basis): 27.59 lbs
12.52 kg

DILUTION TUNNEL & MISC. DATA - ASTM E3053 / E2515

Client:	FPI	Job #:	18-446
Model:	F3500	Tracking #:	0016
Run #:	1	Technician:	SJB
Test Start Time:	10:23	Date:	12/10/2018
Test Type:	High Fire		

Recording Interval (min):	1
Total Sampling Time (min):	209
High Fire Test Load Time (min):	36

Meter Box γ Factor:	1.002	(A)
Meter Box γ Factor:	0.997	(B)
Meter Box γ Factor:	0.999	(Ambient)

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	30.22	30.18	30.20
Relative Humidity (%)	33.7	29.2	
Room Air Velocity (ft/min)	0	0	
Scale Audit (lbs)	10.0	10.0	

Ambient Sample Volume: 27.087 ft^3

Induced Draft Check (in. H_2O):	0
Smoke Capture Check (%):	100%
Date Flue Pipe Last Cleaned:	12/7/2018

Sample Train Post-Test Leak Checks

(A)	0.000	cfm @	-13	in. Hg
(B)	0.000	cfm @	-14	in. Hg
(Ambient)	0.002	cfm @	-14	in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H_2O)	Temp (°F)
1	0.040	64
2	0.048	64
3	0.050	64
4	0.042	64
5	0.044	64
6	0.052	64
7	0.046	64
8	0.040	64
Center	0.050	64

Static Pressure: -0.160 in. H_2O

Dilution Tunnel H_2O:	2.00	percent
Tunnel Diameter:	6	inches
Pitot Tube Cp:	0.99	[unitless]
Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Tunnel Area:	0.1963	ft^2
V_{strav}:	14.04	ft/sec
V_{scent}:	14.69	ft/sec
F_p:	0.956	[ratio]
Initial Tunnel Flow:	163.9	scf/min

TEST FUEL PROPERTIES

ASTM 3053-17 - Table A1.1 Fuel Properties by Fuel Species

Select Fuel Type	Species	%C	%H	%O	%Ash	MJ/kg	BTU/lb
	Ash, White	49.70	6.90	43.00	0.30	20.75	8927
	Beech	48.70	5.80	44.70	0.60	18.80	8088
	Birch, Sweet	49.80	6.50	43.40	0.30	20.12	8656
	Birch, Yellow	49.80	6.50	43.40	0.30	20.12	8656
	Doug Fir (Coast, Interior West/North)	48.73	6.87	43.90	0.50	19.81	8522
	Doug Fir (Interioir South)	48.73	6.87	43.90	0.50	19.81	8522
	Elm, Rock	50.40	6.60	42.30	0.70	20.49	8815
	Elm, Soft	50.40	6.60	42.30	0.70	20.49	8815
	Gum, Red	50.88	6.06	41.57	1.28	19.72	8478
	Larch, Western	50.54	6.36	42.40	0.70	17.58	7558
X	Maple, Hard	50.64	6.02	41.74	1.35	19.96	8587
	Maple, Sugar	50.64	6.02	41.74	1.35	19.96	8587
	Oak, Red	49.50	6.62	43.70	0.20	20.20	8690
	Oak, White	50.40	6.59	42.70	0.20	20.50	8819
	Pine, Southern	52.60	7.00	40.10	1.31	22.30	9587
	Pine, Southern Long Leaf	52.60	7.02	40.10	1.30	22.30	9594
	Other						

WOODSTOVE PREBURN DATA

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

High Fire Test Begins from Cold Start, No Preburn is Performed

BOX A TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.050	0.00	67	-0.07		2.4		64	63	83	62
1	0.136	0.136	0.050	2.43	66	-2	95	2.0	-0.4	98	353	84	62
2	0.280	0.144	0.050	2.28	67	-1.35	107	1.1	-0.9	175	686	85	62
3	0.426	0.146	0.050	2.23	67	-1.95	106	0.7	-0.4	145	482	83	62
4	0.566	0.140	0.050	2.21	67	-0.84	101	2.7	2	140	512	82	62
5	0.711	0.145	0.050	2.21	67	-2.52	102	2.5	-0.2	111	416	82	62
6	0.853	0.142	0.050	2.27	67	-0.21	99	2.3	-0.2	100	401	84	62
7	1.001	0.148	0.050	2.29	67	-2.4	103	2.1	-0.2	97	414	86	62
8	1.143	0.142	0.050	2.26	67	-2.44	98	2.0	-0.1	95	432	85	62
9	1.292	0.149	0.050	2.27	67	-2.58	103	1.8	-0.2	94	447	82	62
10	1.434	0.142	0.050	2.28	68	-0.38	100	5.0	3.2	109	546	82	62
11	1.582	0.148	0.050	2.25	68	-0.17	103	4.8	-0.2	102	510	83	62
12	1.724	0.142	0.050	2.22	68	-2.86	99	4.6	-0.2	101	512	85	62
13	1.871	0.147	0.050	2.24	68	-2.64	102	4.5	-0.1	100	514	86	63
14	2.013	0.142	0.050	2.25	69	-1.98	99	4.2	-0.3	101	516	83	63
15	2.159	0.146	0.050	2.23	69	-0.26	101	4.2	0	101	515	82	63
16	2.301	0.142	0.050	2.20	69	-1.35	100	6.7	2.5	113	577	83	63
17	2.445	0.144	0.050	2.20	70	-2.04	101	6.6	-0.1	109	548	84	63
18	2.589	0.144	0.050	2.20	70	-1.34	100	6.4	-0.2	107	540	86	63
19	2.732	0.143	0.050	2.20	70	-2.89	100	6.2	-0.2	106	541	84	63
20	2.878	0.146	0.050	2.21	70	-0.21	102	6.0	-0.2	105	540	82	63
21	3.020	0.142	0.050	2.21	71	-0.13	99	5.8	-0.2	106	543	82	63
22	3.166	0.146	0.050	2.21	71	-0.11	102	5.7	-0.1	107	547	83	63
23	3.307	0.141	0.050	2.20	72	-0.18	98	5.5	-0.2	107	551	85	64
24	3.454	0.147	0.050	2.18	72	-0.16	102	5.3	-0.2	108	555	85	64
25	3.594	0.140	0.050	2.18	72	-0.65	97	5.1	-0.2	108	558	83	64
26	3.741	0.147	0.050	2.19	73	-0.78	102	4.9	-0.2	108	557	81	64
27	3.882	0.141	0.050	2.18	73	-2.05	98	4.7	-0.2	109	555	82	64
28	4.028	0.146	0.050	2.18	73	-0.22	101	4.6	-0.1	109	556	84	64
29	4.170	0.142	0.050	2.18	74	-0.17	98	4.4	-0.2	109	557	86	64
30	4.317	0.147	0.050	2.19	74	-2.72	102	4.3	-0.1	110	560	84	64
31	4.459	0.142	0.050	2.17	74	-0.15	99	4.0	-0.3	110	564	82	64
32	4.604	0.145	0.050	2.18	75	-2.36	100	3.8	-0.2	111	568	82	65

BOX A TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
33	4.747	0.143	0.050	2.17	75	-2.92	99	3.6	-0.2	112	571	83	65
34	4.890	0.143	0.050	2.17	75	-0.38	99	3.4	-0.2	112	576	85	65
35	5.034	0.144	0.050	2.17	76	-2.68	100	3.3	-0.1	112	581	86	65
36	5.177	0.143	0.050	2.13	76	-0.33	101	21.8	18.5	134	738	83	65
37	5.321	0.144	0.050	2.22	76	-0.78	102	29.4	7.6	133	656	82	65
38	5.465	0.144	0.050	2.22	77	-0.93	101	29.2	-0.2	124	608	82	65
39	5.613	0.148	0.050	2.25	77	-0.32	103	29.0	-0.2	121	594	84	65
40	5.757	0.144	0.050	2.23	77	-0.82	100	28.8	-0.2	119	588	86	65
41	5.905	0.148	0.050	2.22	78	-2.59	103	28.6	-0.2	118	584	83	65
42	6.048	0.143	0.050	2.21	78	-2.13	99	28.4	-0.2	117	579	82	65
43	6.196	0.148	0.050	2.20	78	-1.74	103	28.2	-0.2	117	576	82	65
44	6.340	0.144	0.050	2.22	79	-2.91	99	28.1	-0.1	116	572	84	66
45	6.488	0.148	0.050	2.22	79	-1.98	102	27.9	-0.2	116	569	86	65
46	6.631	0.143	0.050	2.22	79	-0.43	99	27.7	-0.2	116	566	84	65
47	6.780	0.149	0.050	2.23	79	-0.39	103	27.6	-0.1	116	563	82	65
48	6.923	0.143	0.050	2.21	80	-1.62	99	27.4	-0.2	116	560	82	66
49	7.072	0.149	0.050	2.22	80	-3.03	103	27.1	-0.3	115	558	83	66
50	7.216	0.144	0.050	2.21	80	-0.31	99	27.1	0	115	555	85	66
51	7.364	0.148	0.050	2.23	81	-3	102	26.9	-0.2	114	553	85	65
52	7.507	0.143	0.050	2.20	81	-2.89	98	26.8	-0.1	114	551	83	66
53	7.656	0.149	0.050	2.21	81	-0.77	102	26.6	-0.2	114	551	82	66
54	7.800	0.144	0.050	2.21	81	-2.24	99	26.5	-0.1	115	552	83	66
55	7.949	0.149	0.050	2.23	82	-0.56	102	26.3	-0.2	115	552	85	66
56	8.092	0.143	0.050	2.22	82	-2.44	98	26.0	-0.3	114	551	85	66
57	8.247	0.155	0.050	2.24	82	-0.59	106	26.0	0	112	550	83	66
58	8.390	0.143	0.050	2.23	82	-1.84	98	25.8	-0.2	111	545	82	67
59	8.540	0.150	0.050	2.22	83	-1.72	102	25.4	-0.4	111	541	83	67
60	8.683	0.143	0.050	2.21	83	-1.29	98	25.4	0	110	541	85	66
61	8.844	0.161	0.050	2.42	83	-1.74	110	25.3	-0.1	110	543	81	67
62	8.995	0.151	0.050	2.38	83	-1.98	103	25.1	-0.2	109	543	83	67
63	9.146	0.151	0.050	2.35	84	-2.58	103	24.9	-0.2	110	545	85	67
64	9.297	0.151	0.050	2.33	84	-1.27	103	24.7	-0.2	110	546	85	67
65	9.447	0.150	0.050	2.33	84	-0.25	102	24.6	-0.1	110	546	83	67

BOX A TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
66	9.599	0.152	0.050	2.33	84	-0.4	104	24.4	-0.2	110	547	82	67
67	9.746	0.147	0.050	2.32	84	-2.58	100	24.2	-0.2	110	548	82	67
68	9.898	0.152	0.050	2.32	85	-1.76	103	24.0	-0.2	110	549	84	67
69	10.045	0.147	0.050	2.32	85	-2.26	100	23.8	-0.2	110	550	86	67
70	10.198	0.153	0.050	2.31	85	0	104	23.7	-0.1	111	551	84	67
71	10.345	0.147	0.050	2.32	85	-1.22	100	23.5	-0.2	111	553	82	67
72	10.498	0.153	0.050	2.31	85	-1.38	104	23.3	-0.2	110	554	82	67
73	10.645	0.147	0.050	2.31	86	-0.93	100	23.1	-0.2	110	553	84	67
74	10.798	0.153	0.050	2.32	86	-1.25	104	22.9	-0.2	110	553	85	67
75	10.944	0.146	0.050	2.31	86	-0.25	99	22.8	-0.1	111	553	84	68
76	11.095	0.151	0.050	2.29	86	-2.64	103	22.6	-0.2	111	554	82	67
77	11.244	0.149	0.050	2.32	86	-2.15	101	22.4	-0.2	111	557	82	68
78	11.393	0.149	0.050	2.29	87	-1.89	101	22.2	-0.2	111	557	83	68
79	11.544	0.151	0.050	2.30	87	-0.16	102	22.0	-0.2	111	558	85	68
80	11.693	0.149	0.050	2.29	87	-1.24	101	21.8	-0.2	112	559	85	68
81	11.843	0.150	0.050	2.31	87	-1.2	102	21.6	-0.2	112	561	83	68
82	11.991	0.148	0.050	2.29	87	-1.2	100	21.4	-0.2	112	562	82	68
83	12.142	0.151	0.050	2.28	87	-1.14	102	21.2	-0.2	112	566	83	68
84	12.288	0.146	0.050	2.28	88	-1.02	99	21.0	-0.2	113	569	84	68
85	12.440	0.152	0.050	2.26	88	-2.81	103	20.8	-0.2	113	572	86	68
86	12.586	0.146	0.050	2.28	88	-2.52	99	20.6	-0.2	113	577	84	68
87	12.738	0.152	0.050	2.27	88	-2.46	103	20.4	-0.2	113	580	82	68
88	12.884	0.146	0.050	2.27	88	-0.44	99	20.2	-0.2	114	583	82	68
89	13.036	0.152	0.050	2.28	88	-2.69	103	20.0	-0.2	114	585	84	68
90	13.183	0.147	0.050	2.27	88	-2.6	100	19.7	-0.3	114	587	86	68
91	13.334	0.151	0.050	2.26	89	-0.09	102	19.5	-0.2	114	587	84	69
92	13.481	0.147	0.050	2.27	89	-1.82	100	19.3	-0.2	115	590	82	68
93	13.632	0.151	0.050	2.28	89	-0.12	102	19.1	-0.2	115	591	82	68
94	13.778	0.146	0.050	2.28	89	-1.64	99	18.9	-0.2	116	593	83	68
95	13.928	0.150	0.050	2.28	89	-2.52	102	18.6	-0.3	115	593	86	69
96	14.076	0.148	0.050	2.26	89	-2.79	100	18.5	-0.1	116	593	85	69
97	14.225	0.149	0.050	2.25	89	-2.54	101	18.2	-0.3	116	593	83	69
98	14.373	0.148	0.050	2.25	90	-0.67	100	18.0	-0.2	116	591	82	69

BOX A TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
99	14.522	0.149	0.050	2.25	90	-2.43	101	17.7	-0.3	116	593	83	69
100	14.671	0.149	0.050	2.27	90	-0.18	101	17.5	-0.2	116	593	84	69
101	14.819	0.148	0.050	2.26	90	-2.35	100	17.4	-0.1	117	593	86	69
102	14.969	0.150	0.050	2.25	90	-0.37	102	17.1	-0.3	117	593	84	70
103	15.116	0.147	0.050	2.24	90	-0.11	100	16.9	-0.2	117	594	82	69
104	15.267	0.151	0.050	2.25	90	-2.01	102	16.6	-0.3	117	593	82	69
105	15.413	0.146	0.050	2.27	90	-0.29	99	16.5	-0.1	117	595	83	69
106	15.564	0.151	0.050	2.25	90	-2.45	102	16.3	-0.2	117	595	85	69
107	15.709	0.145	0.050	2.24	91	-1.87	98	16.0	-0.3	118	597	85	69
108	15.860	0.151	0.050	2.22	91	-2.52	102	15.8	-0.2	118	595	83	69
109	16.006	0.146	0.050	2.26	91	-0.24	99	15.7	-0.1	118	593	82	69
110	16.156	0.150	0.050	2.24	91	-2.81	102	15.4	-0.3	118	594	83	70
111	16.301	0.145	0.050	2.25	91	-1.2	98	15.1	-0.3	118	593	84	70
112	16.453	0.152	0.050	2.24	91	-2.84	103	15.0	-0.1	118	593	86	70
113	16.598	0.145	0.050	2.24	91	-0.08	98	14.7	-0.3	118	596	84	70
114	16.750	0.152	0.050	2.22	91	-0.41	103	14.5	-0.2	119	595	82	70
115	16.895	0.145	0.050	2.22	91	-1.24	98	14.3	-0.2	119	593	82	69
116	17.046	0.151	0.050	2.22	92	-2.24	102	14.0	-0.3	119	594	84	69
117	17.192	0.146	0.050	2.22	92	-2.58	99	13.8	-0.2	119	594	86	67
118	17.342	0.150	0.050	2.24	92	-0.16	102	13.5	-0.3	120	593	85	68
119	17.488	0.146	0.050	2.23	92	-0.24	99	13.3	-0.2	119	592	83	68
120	17.638	0.150	0.050	2.23	92	-0.32	101	13.0	-0.3	119	592	83	68
121	17.784	0.146	0.050	2.22	92	-0.24	99	12.9	-0.1	119	591	84	69
122	17.933	0.149	0.050	2.22	92	-2.78	101	12.7	-0.2	118	591	86	69
123	18.079	0.146	0.050	2.22	92	-2.07	99	12.5	-0.2	118	592	86	69
124	18.228	0.149	0.050	2.22	92	-2.67	101	12.3	-0.2	118	591	84	69
125	18.374	0.146	0.050	2.20	92	-1.34	99	12.1	-0.2	118	592	82	70
126	18.523	0.149	0.050	2.24	92	-1.89	101	11.8	-0.3	118	592	83	70
127	18.670	0.147	0.050	2.22	92	-2.45	99	11.7	-0.1	118	592	85	70
128	18.818	0.148	0.050	2.19	92	-2.78	100	11.5	-0.2	118	591	86	70
129	18.965	0.147	0.050	2.20	92	-2.79	99	11.3	-0.2	118	591	84	70
130	19.113	0.148	0.050	2.21	93	-2.04	100	11.1	-0.2	118	589	83	71
131	19.260	0.147	0.050	2.20	93	-1.31	99	10.8	-0.3	118	590	83	71

BOX A TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
132	19.408	0.148	0.050	2.22	93	-0.41	100	10.7	-0.1	118	592	84	71
133	19.556	0.148	0.050	2.21	93	-2.73	100	10.5	-0.2	118	590	86	71
134	19.704	0.148	0.050	2.22	93	-1.37	100	10.3	-0.2	118	589	84	71
135	19.852	0.148	0.050	2.21	93	-0.25	100	10.0	-0.3	118	589	83	71
136	19.999	0.147	0.050	2.19	93	-1.17	99	9.9	-0.1	118	588	82	71
137	20.148	0.149	0.050	2.20	93	-1.53	101	9.7	-0.2	118	587	84	71
138	20.294	0.146	0.050	2.20	93	-0.37	98	9.5	-0.2	118	586	85	71
139	20.443	0.149	0.050	2.20	93	-2.86	101	9.2	-0.3	118	586	85	71
140	20.588	0.145	0.050	2.20	93	-2.76	98	9.1	-0.1	117	585	83	68
141	20.738	0.150	0.050	2.20	94	-0.7	101	8.9	-0.2	117	586	82	66
142	20.884	0.146	0.050	2.19	94	-2.58	98	8.7	-0.2	116	585	83	65
143	21.033	0.149	0.050	2.19	94	-1.25	100	8.6	-0.1	116	584	85	65
144	21.179	0.146	0.050	2.20	94	-2.47	98	8.4	-0.2	115	582	85	65
145	21.328	0.149	0.050	2.20	94	-0.45	100	8.3	-0.1	115	581	83	65
146	21.473	0.145	0.050	2.19	94	-2.73	97	8.1	-0.2	115	579	82	67
147	21.623	0.150	0.050	2.20	94	-0.27	101	7.9	-0.2	115	579	83	67
148	21.767	0.144	0.050	2.19	93	-2.18	97	7.8	-0.1	115	576	85	68
149	21.917	0.150	0.050	2.21	93	-0.42	101	7.5	-0.3	115	577	87	68
150	22.061	0.144	0.050	2.20	93	-2.67	97	7.3	-0.2	115	575	85	69
151	22.211	0.150	0.050	2.19	93	-0.54	101	7.3	0	115	573	83	69
152	22.355	0.144	0.050	2.20	93	-1.57	97	7.1	-0.2	115	572	83	69
153	22.505	0.150	0.050	2.19	93	-0.38	101	6.9	-0.2	114	569	84	69
154	22.650	0.145	0.050	2.19	93	-1.57	97	6.9	0	114	565	86	70
155	22.800	0.150	0.050	2.20	93	-2.75	101	6.7	-0.2	113	561	86	69
156	22.945	0.145	0.050	2.20	93	-1.13	97	6.6	-0.1	113	556	84	70
157	23.095	0.150	0.050	2.19	93	-2.05	101	6.4	-0.2	113	550	83	70
158	23.239	0.144	0.050	2.21	93	-2.92	97	6.4	0	113	546	84	70
159	23.390	0.151	0.050	2.20	93	-2.49	101	6.3	-0.1	112	542	85	70
160	23.534	0.144	0.050	2.21	93	-0.63	97	6.1	-0.2	111	539	86	70
161	23.685	0.151	0.050	2.19	93	-1.03	101	6.1	0	112	535	84	70
162	23.830	0.145	0.050	2.19	93	-1.82	97	6.0	-0.1	111	531	83	70
163	23.981	0.151	0.050	2.20	93	-0.39	101	5.9	-0.1	111	527	83	70
164	24.126	0.145	0.050	2.21	94	-0.48	97	5.8	-0.1	111	526	85	70

BOX A TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
165	24.276	0.150	0.050	2.20	94	-0.44	100	5.7	-0.1	110	526	87	70
166	24.421	0.145	0.050	2.20	94	-2.86	97	5.6	-0.1	110	525	85	70
167	24.572	0.151	0.050	2.20	94	-1.97	101	5.5	-0.1	110	522	83	70
168	24.717	0.145	0.050	2.20	94	-0.71	97	5.4	-0.1	110	519	83	71
169	24.867	0.150	0.050	2.20	94	-2.26	100	5.2	-0.2	110	518	84	70
170	25.012	0.145	0.050	2.20	94	-0.34	97	5.2	0	109	514	85	70
171	25.162	0.150	0.050	2.20	94	-2.74	100	5.1	-0.1	109	513	86	71
172	25.308	0.146	0.050	2.22	94	-2.85	98	5.0	-0.1	109	510	84	70
173	25.457	0.149	0.050	2.20	94	-0.23	99	5.0	0	108	506	83	71
174	25.603	0.146	0.050	2.21	94	-2.49	97	4.9	-0.1	108	505	83	70
175	25.752	0.149	0.050	2.21	94	-2.35	99	4.8	-0.1	108	500	85	71
176	25.898	0.146	0.050	2.21	94	-0.45	97	4.8	0	108	495	86	71
177	26.047	0.149	0.050	2.19	94	-2.71	99	4.6	-0.2	107	491	84	71
178	26.194	0.147	0.050	2.20	94	-2.45	98	4.6	0	107	486	83	70
179	26.342	0.148	0.050	2.19	94	-2.74	99	4.6	0	106	483	83	70
180	26.489	0.147	0.050	2.20	94	-0.12	98	4.5	-0.1	106	479	84	70
181	26.637	0.148	0.050	2.20	94	-1.88	99	4.4	-0.1	106	477	86	71
182	26.785	0.148	0.050	2.21	94	-0.72	99	4.4	0	105	475	85	71
183	26.933	0.148	0.050	2.18	94	-0.73	99	4.3	-0.1	106	472	83	71
184	27.082	0.149	0.050	2.19	95	-1.34	99	4.2	-0.1	105	470	82	71
185	27.230	0.148	0.050	2.20	95	-2.96	98	4.2	0	105	468	84	71
186	27.378	0.148	0.050	2.19	95	-1.1	98	4.1	-0.1	104	466	85	71
187	27.525	0.147	0.050	2.20	95	-0.84	98	4.0	-0.1	104	464	86	71
188	27.675	0.150	0.050	2.20	95	-0.21	100	4.0	0	104	463	84	71
189	27.821	0.146	0.050	2.20	95	-0.39	97	3.9	-0.1	104	462	82	71
190	27.971	0.150	0.050	2.20	95	-2.44	100	3.8	-0.1	104	461	83	71
191	28.117	0.146	0.050	2.21	95	-1.14	97	3.8	0	104	461	85	71
192	28.267	0.150	0.050	2.22	95	-2.16	100	3.7	-0.1	104	461	86	71
193	28.413	0.146	0.050	2.21	95	-0.56	97	3.7	0	103	460	84	70
194	28.562	0.149	0.050	2.22	95	-0.47	99	3.6	-0.1	103	458	83	71
195	28.707	0.145	0.050	2.22	95	-0.18	96	3.5	-0.1	103	457	83	71
196	28.858	0.151	0.050	2.19	95	-2.78	100	3.5	0	103	456	84	71
197	29.004	0.146	0.050	2.22	95	-0.29	97	3.4	-0.1	103	455	86	72

BOX A TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
198	29.154	0.150	0.050	2.21	95	-2.17	100	3.3	-0.1	103	455	85	71
199	29.299	0.145	0.050	2.19	95	-1.68	96	3.2	-0.1	103	452	83	71
200	29.450	0.151	0.050	2.22	95	-0.19	100	3.2	0	103	453	82	71
201	29.595	0.145	0.050	2.19	95	-0.32	96	3.2	0	102	452	83	71
202	29.746	0.151	0.050	2.20	95	-0.21	100	3.1	-0.1	102	450	85	71
203	29.892	0.146	0.050	2.21	96	-2.66	97	3.1	0	102	451	86	71
204	30.042	0.150	0.050	2.20	96	-0.15	99	3.0	-0.1	102	449	84	71
205	30.188	0.146	0.050	2.20	96	-2.83	97	2.9	-0.1	102	447	82	71
206	30.338	0.150	0.050	2.19	96	-0.29	99	2.9	0	102	446	83	71
207	30.484	0.146	0.050	2.19	96	-1.62	97	2.8	-0.1	102	445	84	71
208	30.634	0.150	0.050	2.19	96	-0.64	99	2.8	0	101	443	86	72
209	30.780	0.146	0.050	2.21	96	-2.88	97	2.7	-0.1	101	442	85	71
Avg/Tot	30.780	0.147	0.050	2.22	86	-1.47	100			112	543	84	67.8

BOX B TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
0	0.000		0.00	66	-1		83	0.000	0.07	0.03
1	0.139	0.139	2.44	66	-1.69	98	83	-0.070	0.08	0.00
2	0.287	0.148	2.33	66	-2.82	112	83	-0.090	5.91	0.16
3	0.427	0.140	2.29	66	-0.86	103	84	-0.070	10.11	0.32
4	0.572	0.145	2.26	66	-1.5	106	85	-0.080	9.86	0.00
5	0.713	0.141	2.25	66	-1.96	101	85	-0.070	9.19	0.03
6	0.858	0.145	2.27	66	-2.24	103	84	-0.060	13.72	0.01
7	1.000	0.142	2.26	66	-2.58	100	83	-0.060	15.54	0.08
8	1.144	0.144	2.25	66	-0.92	101	83	-0.070	16.76	0.30
9	1.286	0.142	2.26	67	-2.35	100	84	-0.080	17.38	0.28
10	1.427	0.141	2.25	67	-1.64	100	84	-0.080	15.87	0.15
11	1.571	0.144	2.24	67	-2.78	102	84	-0.070	17.12	0.36
12	1.712	0.141	2.25	67	-1.04	100	85	-0.070	16.70	0.12
13	1.857	0.145	2.24	67	-2.28	102	85	-0.090	16.55	0.15
14	1.997	0.140	2.23	68	-1.49	99	84	-0.080	15.35	0.04
15	2.141	0.144	2.22	68	-0.97	102	84	-0.080	14.78	0.04
16	2.281	0.140	2.22	68	-1.4	100	84	-0.100	15.13	0.06
17	2.425	0.144	2.23	69	-1.96	102	84	-0.080	17.14	3.58
18	2.566	0.141	2.23	69	-2.3	100	84	-0.070	17.77	2.81
19	2.709	0.143	2.21	69	-2.86	101	85	-0.090	17.10	0.88
20	2.851	0.142	2.22	70	-1.04	100	85	-0.080	17.13	1.10
21	2.991	0.140	2.20	70	-1.21	99	85	-0.090	16.17	0.25
22	3.135	0.144	2.20	70	-2.99	102	84	-0.090	17.07	0.17
23	3.277	0.142	2.20	71	-0.95	100	84	-0.080	17.82	0.48
24	3.421	0.144	2.19	71	-2.14	102	84	-0.070	18.47	0.93
25	3.560	0.139	2.20	71	-2.34	98	84	-0.080	18.45	1.06
26	3.704	0.144	2.20	72	-2.12	102	85	-0.090	18.15	1.15
27	3.844	0.140	2.21	72	-0.9	99	85	-0.080	17.79	1.09
28	3.989	0.145	2.20	72	-1.01	102	85	-0.080	17.69	0.73
29	4.130	0.141	2.20	73	-3.06	99	85	-0.090	17.71	0.73
30	4.273	0.143	2.20	73	-2.97	101	84	-0.080	17.89	0.79
31	4.414	0.141	2.19	73	-2.11	99	84	-0.070	18.16	0.81

BOX B TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
32	4.555	0.141	2.19	74	-0.99	99	84	-0.090	18.35	1.02
33	4.699	0.144	2.20	74	-1.98	101	85	-0.080	18.66	1.06
34	4.841	0.142	2.19	74	-1.74	100	85	-0.100	19.16	0.88
35	4.985	0.144	2.18	75	-1.42	101	85	-0.090	19.14	1.12
36	5.124	0.139	2.13	75	-1.93	100	85	-0.100	18.44	0.95
37	5.267	0.143	2.14	75	-1.43	102	84	-0.080	14.51	1.66
38	5.406	0.139	2.14	76	-3.09	99	84	-0.090	15.89	0.59
39	5.550	0.144	2.19	76	-3.31	102	84	-0.090	14.20	0.08
40	5.693	0.143	2.27	76	-2.64	101	85	-0.090	14.34	0.03
41	5.840	0.147	2.27	77	-2.77	104	85	-0.080	14.78	0.04
42	5.985	0.145	2.27	77	-2.37	102	86	-0.080	14.81	0.02
43	6.131	0.146	2.27	77	-1.86	103	85	-0.080	14.96	0.01
44	6.276	0.145	2.27	78	-3.21	102	85	-0.080	14.82	0.02
45	6.422	0.146	2.26	78	-1.85	102	84	-0.070	14.35	0.06
46	6.567	0.145	2.27	78	-3.03	102	84	-0.080	14.10	0.03
47	6.713	0.146	2.28	79	-3.19	102	85	-0.070	14.00	0.01
48	6.859	0.146	2.28	79	-1.29	102	85	-0.080	13.90	0.04
49	7.004	0.145	2.26	79	-3.09	101	85	-0.090	13.58	0.01
50	7.151	0.147	2.26	79	-1.45	103	85	-0.090	13.41	0.02
51	7.296	0.145	2.26	80	-1.08	101	84	-0.080	13.54	0.07
52	7.443	0.147	2.26	80	-3.23	103	84	-0.080	13.34	0.01
53	7.588	0.145	2.27	80	-1.93	101	85	-0.070	13.62	0.04
54	7.735	0.147	2.27	80	-1.8	103	85	-0.090	14.16	0.05
55	7.880	0.145	2.28	81	-2.41	101	85	-0.080	14.21	0.04
56	8.028	0.148	2.27	81	-2.84	103	85	-0.080	14.33	0.01
57	8.173	0.145	2.27	81	-3.23	101	85	-0.090	14.40	0.06
58	8.321	0.148	2.27	81	-1.22	103	84	-0.080	14.56	0.03
59	8.466	0.145	2.27	82	-3.14	101	84	-0.070	14.78	0.03
60	8.614	0.148	2.27	82	-2.89	103	85	-0.080	14.94	0.05
61	8.759	0.145	2.25	82	-3.12	100	85	-0.090	15.26	0.06
62	8.907	0.148	2.27	82	-1.62	102	86	-0.080	15.78	0.08
63	9.052	0.145	2.26	83	-1.97	100	85	-0.100	15.46	0.09

BOX B TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
64	9.200	0.148	2.27	83	-3.13	102	85	-0.070	15.49	0.06
65	9.345	0.145	2.26	83	-1.27	100	84	-0.080	15.45	0.07
66	9.493	0.148	2.26	83	-1.41	102	84	-0.080	15.58	0.02
67	9.638	0.145	2.26	83	-3.01	100	85	-0.080	15.70	0.04
68	9.786	0.148	2.28	84	-3.2	102	85	-0.080	15.72	0.10
69	9.931	0.145	2.26	84	-1.59	100	86	-0.080	16.01	0.10
70	10.079	0.148	2.26	84	-2.91	102	85	-0.090	15.98	0.14
71	10.224	0.145	2.26	84	-2.67	100	84	-0.080	16.03	0.15
72	10.372	0.148	2.25	84	-3.26	102	84	-0.080	15.97	0.19
73	10.517	0.145	2.26	85	-1.36	100	85	-0.090	15.84	0.14
74	10.665	0.148	2.25	85	-1.39	102	85	-0.090	15.64	0.14
75	10.810	0.145	2.25	85	-3.26	100	85	-0.090	15.83	0.14
76	10.958	0.148	2.26	85	-1.42	102	86	-0.080	15.98	0.18
77	11.102	0.144	2.26	85	-2.67	99	85	-0.080	16.22	0.20
78	11.250	0.148	2.24	86	-3.09	102	85	-0.080	16.36	0.16
79	11.395	0.145	2.23	86	-2.48	100	84	-0.090	16.27	0.15
80	11.543	0.148	2.22	86	-2.48	102	85	-0.090	16.23	0.16
81	11.687	0.144	2.24	86	-3.2	99	85	-0.090	16.59	0.18
82	11.835	0.148	2.24	86	-3.29	102	86	-0.090	16.81	0.19
83	11.979	0.144	2.24	86	-2.73	99	86	-0.090	17.15	0.19
84	12.127	0.148	2.24	86	-2.34	102	85	-0.090	17.27	0.21
85	12.272	0.145	2.23	87	-3.06	100	85	-0.090	17.61	0.27
86	12.420	0.148	2.23	87	-2.61	102	85	-0.080	17.88	0.30
87	12.564	0.144	2.22	87	-2.28	99	85	-0.100	18.03	0.28
88	12.712	0.148	2.22	87	-1.32	102	85	-0.090	18.03	0.34
89	12.856	0.144	2.22	87	-1.4	99	86	-0.080	18.21	0.28
90	13.004	0.148	2.21	87	-2.84	102	85	-0.080	18.20	0.38
91	13.147	0.143	2.21	88	-3	98	85	-0.080	18.33	0.44
92	13.295	0.148	2.21	88	-3.19	102	85	-0.080	18.36	0.45
93	13.438	0.143	2.22	88	-3.3	98	85	-0.090	18.29	0.59
94	13.586	0.148	2.21	88	-2.9	102	85	-0.080	18.69	0.51
95	13.730	0.144	2.22	88	-1.26	99	86	-0.090	18.45	0.63

BOX B TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
96	13.878	0.148	2.22	88	-2.39	102	86	-0.090	18.47	0.69
97	14.021	0.143	2.21	88	-3.3	99	85	-0.090	18.48	0.73
98	14.169	0.148	2.19	89	-2.34	102	85	-0.090	18.74	0.71
99	14.312	0.143	2.21	89	-2.99	98	85	-0.100	18.72	0.78
100	14.460	0.148	2.19	89	-2.65	102	85	-0.080	18.51	0.85
101	14.603	0.143	2.19	89	-3.28	98	85	-0.090	18.67	0.94
102	14.750	0.147	2.19	89	-1.27	101	86	-0.090	18.61	0.89
103	14.894	0.144	2.20	89	-3.3	99	85	-0.090	18.93	0.76
104	15.042	0.148	2.21	89	-3.34	102	85	-0.090	18.70	1.14
105	15.185	0.143	2.19	89	-2.41	98	85	-0.090	18.59	1.34
106	15.333	0.148	2.20	90	-1.75	102	85	-0.090	18.88	1.41
107	15.476	0.143	2.17	90	-3.32	98	85	-0.090	18.57	1.54
108	15.623	0.147	2.20	90	-3.31	101	86	-0.080	18.76	1.69
109	15.767	0.144	2.19	90	-2.51	99	85	-0.090	18.82	1.81
110	15.914	0.147	2.18	90	-1.66	101	85	-0.090	18.66	1.69
111	16.058	0.144	2.19	90	-3.09	99	84	-0.080	18.57	1.60
112	16.205	0.147	2.20	90	-3.42	101	85	-0.090	18.49	1.60
113	16.350	0.145	2.19	90	-2.57	100	85	-0.090	18.26	1.57
114	16.496	0.146	2.20	90	-3.32	101	85	-0.090	17.83	2.64
115	16.641	0.145	2.19	91	-3.33	100	86	-0.100	18.24	3.04
116	16.786	0.145	2.19	91	-2.85	100	85	-0.080	18.24	2.84
117	16.932	0.146	2.19	91	-2.09	100	85	-0.080	18.48	2.54
118	17.077	0.145	2.18	91	-2.88	100	85	-0.090	18.53	2.19
119	17.222	0.145	2.17	91	-3.03	100	85	-0.080	18.68	1.85
120	17.367	0.145	2.18	91	-3.2	100	85	-0.090	18.66	1.56
121	17.512	0.145	2.17	91	-3.36	100	85	-0.090	18.79	1.46
122	17.656	0.144	2.17	91	-2.07	99	86	-0.090	18.83	1.26
123	17.803	0.147	2.18	91	-1.35	101	85	-0.090	18.71	1.12
124	17.947	0.144	2.19	91	-2.44	99	85	-0.090	18.91	0.98
125	18.094	0.147	2.18	91	-1.33	101	85	-0.090	18.92	1.00
126	18.237	0.143	2.16	91	-2.9	98	85	-0.090	18.98	0.95
127	18.385	0.148	2.18	91	-2.4	102	86	-0.090	18.83	0.93

BOX B TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
128	18.528	0.143	2.18	92	-1.45	98	86	-0.090	18.91	0.91
129	18.676	0.148	2.19	92	-1.28	101	85	-0.090	18.97	0.89
130	18.819	0.143	2.17	92	-1.85	98	85	-0.080	18.97	0.89
131	18.967	0.148	2.19	92	-3.07	101	85	-0.100	18.91	0.91
132	19.109	0.142	2.17	92	-3.34	97	85	-0.080	18.94	1.23
133	19.257	0.148	2.16	92	-3.13	101	85	-0.090	18.69	1.57
134	19.400	0.143	2.17	92	-1.3	98	86	-0.080	18.80	1.55
135	19.547	0.147	2.16	92	-1.37	101	86	-0.090	18.66	1.51
136	19.689	0.142	2.16	92	-3.03	97	85	-0.090	18.70	1.47
137	19.836	0.147	2.16	92	-1.37	101	85	-0.080	18.82	1.41
138	19.978	0.142	2.15	92	-3.35	97	85	-0.090	18.76	1.28
139	20.125	0.147	2.15	92	-1.39	101	85	-0.090	18.99	0.96
140	20.268	0.143	2.17	93	-1.72	98	85	-0.090	18.71	0.78
141	20.415	0.147	2.16	93	-2.59	100	86	-0.080	18.70	0.61
142	20.558	0.143	2.15	93	-3.41	98	86	-0.090	18.68	0.48
143	20.705	0.147	2.16	93	-3.39	100	85	-0.090	18.21	0.49
144	20.849	0.144	2.15	93	-1.4	98	85	-0.080	18.14	0.42
145	20.994	0.145	2.14	93	-2.38	99	84	-0.090	18.14	0.39
146	21.138	0.144	2.15	93	-3.27	98	85	-0.080	18.17	0.40
147	21.283	0.145	2.15	93	-1.44	99	85	-0.090	18.04	0.40
148	21.427	0.144	2.14	93	-1.64	98	85	-0.080	18.18	0.35
149	21.571	0.144	2.15	93	-3.23	98	86	-0.080	17.89	0.37
150	21.716	0.145	2.15	93	-3.05	99	85	-0.090	17.97	0.32
151	21.859	0.143	2.16	93	-1.49	98	85	-0.080	17.96	0.42
152	22.006	0.147	2.16	93	-3.19	100	85	-0.080	17.22	0.51
153	22.149	0.143	2.15	93	-3.48	97	85	-0.080	17.00	0.24
154	22.296	0.147	2.16	93	-2.71	100	85	-0.080	16.81	0.08
155	22.439	0.143	2.16	93	-1.76	97	86	-0.090	16.47	0.01
156	22.586	0.147	2.15	93	-2.88	100	86	-0.080	15.80	0.02
157	22.729	0.143	2.15	93	-2.49	97	85	-0.080	14.98	0.03
158	22.876	0.147	2.13	93	-2.87	100	85	-0.080	14.53	0.04
159	23.018	0.142	2.14	93	-1.49	97	84	-0.080	14.45	0.03

BOX B TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
160	23.166	0.148	2.16	93	-2.76	101	85	-0.080	14.42	0.02
161	23.308	0.142	2.14	93	-2.2	97	85	-0.080	14.35	0.02
162	23.455	0.147	2.16	93	-1.31	100	86	-0.090	14.15	0.03
163	23.597	0.142	2.15	93	-1.41	97	86	-0.080	14.04	0.00
164	23.744	0.147	2.16	93	-2.09	100	85	-0.070	13.96	0.02
165	23.886	0.142	2.15	93	-1.51	96	84	-0.080	13.48	0.01
166	24.034	0.148	2.17	93	-1.43	101	84	-0.070	13.38	0.01
167	24.178	0.144	2.17	93	-1.42	98	85	-0.080	13.20	0.07
168	24.324	0.146	2.16	93	-1.2	99	85	-0.070	13.08	0.04
169	24.468	0.144	2.18	93	-2.58	98	86	-0.080	13.01	0.05
170	24.615	0.147	2.17	93	-1.96	100	86	-0.070	13.11	0.03
171	24.759	0.144	2.17	93	-1.93	98	85	-0.070	12.81	0.05
172	24.906	0.147	2.16	93	-1.75	100	85	-0.080	12.73	0.03
173	25.051	0.145	2.16	93	-3.32	98	84	-0.080	12.78	0.03
174	25.196	0.145	2.16	93	-1.65	98	84	-0.070	12.61	0.01
175	25.341	0.145	2.17	93	-3.27	98	85	-0.080	12.32	0.01
176	25.487	0.146	2.17	93	-2.86	99	85	-0.070	11.81	0.02
177	25.632	0.145	2.17	93	-1.44	98	86	-0.070	11.51	0.01
178	25.778	0.146	2.18	93	-1.55	99	85	-0.080	11.23	0.04
179	25.923	0.145	2.16	94	-1.67	98	85	-0.070	11.33	0.00
180	26.069	0.146	2.18	94	-1.46	99	84	-0.070	11.18	0.00
181	26.215	0.146	2.18	94	-2.18	99	84	-0.080	11.15	0.03
182	26.360	0.145	2.18	94	-3.17	98	85	-0.080	11.21	0.00
183	26.506	0.146	2.18	94	-2.42	99	85	-0.070	11.18	0.00
184	26.651	0.145	2.17	94	-1.81	98	86	-0.080	10.97	0.00
185	26.798	0.147	2.17	94	-2.87	99	86	-0.070	11.12	0.01
186	26.943	0.145	2.18	94	-2.09	98	85	-0.080	11.08	0.02
187	27.090	0.147	2.18	94	-1.36	99	85	-0.060	11.32	0.01
188	27.235	0.145	2.18	94	-2.23	98	84	-0.070	11.37	0.00
189	27.382	0.147	2.19	94	-3.17	99	85	-0.080	11.21	0.01
190	27.527	0.145	2.19	94	-1.37	98	85	-0.070	11.17	0.03
191	27.675	0.148	2.19	94	-2.96	100	86	-0.070	11.13	0.02

BOX B TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
192	27.820	0.145	2.18	94	-2.57	98	86	-0.070	11.26	0.00
193	27.967	0.147	2.17	94	-1.32	99	85	-0.070	11.11	0.02
194	28.112	0.145	2.19	94	-2.89	98	85	-0.070	11.00	0.02
195	28.259	0.147	2.18	94	-2.84	99	84	-0.060	10.96	0.00
196	28.404	0.145	2.18	95	-2.94	98	84	-0.070	10.76	0.03
197	28.552	0.148	2.17	95	-1.29	100	85	-0.070	10.95	0.00
198	28.696	0.144	2.18	95	-2.21	97	85	-0.080	11.04	0.00
199	28.844	0.148	2.20	95	-1.24	100	86	-0.070	11.05	0.00
200	28.988	0.144	2.20	95	-1.16	97	85	-0.070	11.04	0.03
201	29.137	0.149	2.18	95	-2.08	100	85	-0.070	11.14	0.00
202	29.281	0.144	2.19	95	-3.22	97	84	-0.070	10.95	0.00
203	29.429	0.148	2.19	95	-2.98	99	85	-0.080	10.89	0.00
204	29.573	0.144	2.17	95	-2.68	97	85	-0.070	10.92	0.02
205	29.722	0.149	2.18	95	-1.43	100	85	-0.070	10.98	0.00
206	29.866	0.144	2.19	95	-1.52	97	86	-0.070	10.79	0.02
207	30.015	0.149	2.19	95	-1.24	100	85	-0.070	10.94	0.02
208	30.159	0.144	2.18	95	-3.3	97	85	-0.070	10.98	0.00
209	30.307	0.148	2.18	95	-2.94	99	84	-0.060	10.91	0.00
Avg/Tot	30.307	0.145	2.19	86	-2.28	100			15.50	0.49

WOODSTOVE SURFACE TEMPERATURE DATA

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
0	63	62	63	63	62	62.6	63
1	63	63	63	63	62	62.8	100
2	70	67	73	71	62	68.6	213
3	85	77	95	85	63	81.0	382
4	98	90	114	101	63	93.2	517
5	111	103	132	117	65	105.6	590
6	122	114	147	139	67	117.8	658
7	131	124	158	160	70	128.6	744
8	140	134	168	187	73	140.4	829
9	149	144	177	211	77	151.6	895
10	159	153	184	236	82	162.8	946
11	168	162	191	248	86	171.0	964
12	177	170	198	280	90	183.0	986
13	185	178	205	303	95	193.2	994
14	193	186	212	324	100	203.0	984
15	201	193	219	336	104	210.6	970
16	209	202	226	356	108	220.2	977
17	216	211	233	374	113	229.4	990
18	223	219	239	379	117	235.4	1008
19	229	227	244	389	121	242.0	1033
20	235	235	250	411	125	251.2	1052
21	241	242	255	438	129	261.0	1067
22	248	248	260	458	132	269.2	1080
23	256	254	266	471	136	276.6	1089
24	266	259	272	459	139	279.0	1091
25	276	265	279	475	143	287.6	1094
26	286	271	285	488	146	295.2	1095
27	296	276	292	505	150	303.8	1094
28	305	282	299	512	153	310.2	1094
29	315	287	308	523	156	317.8	1095
30	325	293	316	509	160	320.6	1098
31	336	298	325	526	163	329.6	1102
32	346	304	334	525	166	335.0	1104
33	358	310	343	534	169	342.8	1106
34	370	315	351	535	172	348.6	1113
35	383	321	359	543	175	356.2	1121
36	395	327	368	514	179	356.6	1166
37	404	335	377	521	181	363.6	1136
38	409	340	383	530	184	369.2	1112
39	411	344	385	520	187	369.4	1100
40	411	346	387	544	190	375.6	1094
41	410	347	388	552	193	378.0	1093
42	408	348	388	542	196	376.4	1091
43	405	349	388	544	198	376.8	1086
44	402	350	388	547	201	377.6	1081
45	398	350	388	547	203	377.2	1076
46	395	351	387	553	206	378.4	1072
47	391	351	387	556	208	378.6	1068

WOODSTOVE SURFACE TEMPERATURE DATA

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
48	388	351	386	544	210	375.8	1064
49	385	352	385	550	212	376.8	1060
50	382	352	385	547	213	375.8	1056
51	379	352	384	545	215	375.0	1052
52	376	353	383	540	217	373.8	1049
53	373	353	382	528	218	370.8	1048
54	371	353	381	540	219	372.8	1048
55	369	354	381	539	220	372.6	1050
56	367	355	380	537	222	372.2	1053
57	365	355	385	492	223	364.0	1057
58	364	356	387	477	223	361.4	1063
59	363	357	387	480	224	362.2	1069
60	362	358	387	464	225	359.2	1076
61	361	360	386	476	226	361.8	1086
62	360	361	385	475	226	361.4	1097
63	359	362	384	461	227	358.6	1105
64	358	363	383	474	228	361.2	1110
65	358	364	382	477	228	361.8	1112
66	358	365	381	458	229	358.2	1113
67	357	366	380	462	229	358.8	1113
68	357	368	378	476	229	361.6	1115
69	357	369	378	468	230	360.4	1121
70	357	370	377	468	230	360.4	1126
71	357	371	376	467	231	360.4	1130
72	357	372	376	474	231	362.0	1131
73	357	374	375	470	232	361.6	1129
74	357	375	375	475	232	362.8	1129
75	357	376	375	491	233	366.4	1131
76	357	377	375	476	234	363.8	1136
77	357	379	374	471	234	363.0	1141
78	357	380	374	473	235	363.8	1143
79	357	381	375	477	236	365.2	1145
80	357	382	375	480	236	366.0	1147
81	358	384	376	475	237	366.0	1150
82	358	385	376	478	238	367.0	1154
83	358	387	377	484	239	369.0	1158
84	358	388	378	478	241	368.6	1163
85	359	390	378	483	242	370.4	1168
86	359	391	379	485	244	371.6	1173
87	360	393	380	488	245	373.2	1178
88	360	394	381	499	247	376.2	1181
89	361	396	382	498	249	377.2	1184
90	361	398	383	494	250	377.2	1187
91	362	399	385	499	253	379.6	1190
92	363	401	386	497	255	380.4	1194
93	364	402	388	495	257	381.2	1196
94	365	404	389	506	259	384.6	1198
95	366	406	391	507	261	386.2	1199

WOODSTOVE SURFACE TEMPERATURE DATA

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
96	367	407	392	520	264	390.0	1200
97	368	409	395	511	266	389.8	1200
98	370	410	397	520	269	393.2	1201
99	371	412	398	519	271	394.2	1201
100	373	414	400	512	274	394.6	1202
101	374	416	403	511	277	396.2	1202
102	376	417	405	527	279	400.8	1198
103	378	419	408	525	282	402.4	1196
104	380	422	411	520	285	403.6	1194
105	382	424	415	524	287	406.4	1193
106	384	427	418	524	290	408.6	1194
107	386	429	422	523	293	410.6	1195
108	389	432	427	519	296	412.6	1197
109	391	435	431	521	299	415.4	1199
110	394	437	436	519	301	417.4	1199
111	396	440	441	523	304	420.8	1196
112	399	443	446	523	307	423.6	1193
113	401	445	452	515	310	424.6	1192
114	404	448	458	522	312	428.8	1186
115	406	450	463	516	315	430.0	1179
116	409	454	469	516	318	433.2	1175
117	411	457	475	510	320	434.6	1175
118	414	459	480	498	322	434.6	1177
119	417	462	485	500	324	437.6	1179
120	420	465	489	500	326	440.0	1181
121	423	467	494	499	327	442.0	1182
122	426	470	498	495	328	443.4	1182
123	429	473	503	506	329	448.0	1182
124	432	475	507	499	330	448.6	1183
125	436	477	512	507	330	452.4	1184
126	439	479	517	502	331	453.6	1185
127	442	481	521	505	331	456.0	1186
128	446	483	526	512	331	459.6	1185
129	448	485	531	504	331	459.8	1184
130	451	487	536	505	331	462.0	1183
131	454	489	541	511	331	465.2	1183
132	457	490	546	508	331	466.4	1184
133	459	492	551	515	331	469.6	1183
134	462	494	555	515	331	471.4	1183
135	464	496	559	500	331	470.0	1182
136	467	498	562	514	331	474.4	1182
137	469	500	565	514	331	475.8	1182
138	471	502	569	514	332	477.6	1182
139	474	504	572	528	332	482.0	1182
140	475	506	575	514	332	480.4	1181
141	477	508	578	517	333	482.6	1180
142	480	510	580	515	333	483.6	1180
143	481	512	583	521	333	486.0	1178

WOODSTOVE SURFACE TEMPERATURE DATA

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
144	483	514	586	509	333	485.0	1175
145	485	515	588	513	333	486.8	1172
146	487	517	591	498	334	485.4	1169
147	489	519	593	505	334	488.0	1167
148	491	521	595	497	335	487.8	1166
149	493	523	598	503	335	490.4	1165
150	495	524	601	499	336	491.0	1165
151	497	525	603	502	336	492.6	1168
152	498	526	606	510	337	495.4	1170
153	500	526	608	513	337	496.8	1169
154	501	527	610	513	338	497.8	1162
155	503	527	612	506	338	497.2	1153
156	504	527	613	507	339	498.0	1142
157	506	527	614	499	340	497.2	1128
158	507	527	616	495	341	497.2	1113
159	508	527	617	486	342	496.0	1099
160	509	526	618	493	343	497.8	1086
161	511	526	619	485	345	497.2	1075
162	511	525	619	481	346	496.4	1066
163	512	525	617	484	348	497.2	1063
164	511	525	615	483	349	496.6	1064
165	511	525	614	472	350	494.4	1064
166	511	525	612	469	352	493.8	1061
167	510	525	610	468	353	493.2	1054
168	510	525	609	465	354	492.6	1047
169	509	525	607	459	355	491.0	1039
170	509	525	606	464	356	492.0	1032
171	508	524	604	443	356	487.0	1025
172	507	524	602	444	357	486.8	1019
173	506	523	600	450	357	487.2	1013
174	505	522	598	450	358	486.6	1007
175	504	522	597	439	358	484.0	999
176	503	520	595	442	358	483.6	989
177	502	519	593	427	358	479.8	976
178	502	518	591	437	358	481.2	965
179	501	516	589	423	358	477.4	954
180	501	514	586	425	357	476.6	946
181	500	511	584	413	357	473.0	939
182	500	509	582	420	357	473.6	933
183	499	507	581	408	357	470.4	927
184	498	504	581	410	357	470.0	920
185	497	502	581	399	357	467.2	914
186	496	500	581	395	357	465.8	910
187	496	498	580	393	357	464.8	908
188	495	497	580	391	357	464.0	908
189	494	495	580	392	357	463.6	908
190	493	493	579	386	357	461.6	908
191	492	492	579	379	357	459.8	908

WOODSTOVE SURFACE TEMPERATURE DATA

Client: FPI
Model: F3500
Run #: 1

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/10/2018

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
192	491	490	578	383	356	459.6	907
193	490	489	578	377	356	458.0	905
194	489	487	577	378	356	457.4	902
195	488	486	577	377	356	456.8	899
196	487	485	575	368	356	454.2	896
197	486	484	575	372	356	454.6	893
198	485	482	574	372	356	453.8	891
199	484	481	574	366	356	452.2	889
200	484	480	574	367	356	452.2	888
201	483	479	573	367	356	451.6	886
202	482	478	573	367	356	451.2	885
203	481	477	572	365	356	450.2	884
204	481	476	571	363	356	449.4	882
205	480	474	570	363	356	448.6	880
206	480	473	569	363	356	448.2	876
207	480	472	568	363	356	447.8	873
208	479	471	567	357	356	446.0	870
209	479	470	566	356	357	445.6	867
Average	396	405	445	456	265	393	1059

LAB SAMPLE DATA - ASTM E2515

Client: FPI
Job #: 18-446
Model: F3500
Tracking #: 0016
Run #: 1
Technician: SJB
Date: 12/10/2018

TRAIN A (1st Hour)

Sample Component	Sample Type	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	T044	91.1	86.6	4.5
B. Rear filter catch	Filter				0.0
C. Probe catch*	Probe				0.0
D. O-Ring catch*	O-Ring				0.0

Sub-Total	Total Particulate, mg:	4.5

TRAIN A (Post 1st hour)

Sample Component	Sample Type	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	T045	178.8	87.4	3.4
B. Rear filter catch	Filter	T046		88.0	
C. Probe catch*	Probe	5A	116769.3	116768.6	0.7
D. O-Ring catch*	O-Ring	5A	3534.1	3534.1	0.0

Sub-Total	Total Particulate, mg:	4.1
Train A Aggregate	Total Particulate, mg:	**8.6**

TRAIN B

Sample Component	Reagent	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	T047	182.5	87.5	7.9
B. Rear filter catch	Filter	T048		87.1	
C. Probe catch*	Probe	5B	116881.2	116880.6	0.6
D. O-Ring catch*	O-Ring	5B	3530.7	3530.5	0.2

Total Particulate, mg:	**8.7**

AMBIENT

Sample Component	Reagent	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Filter catch*	Filter	T049	87.4	87.4	0.0

Total Particulate, mg:	**0.0**

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

ASTM E3053 Wood Heater Run Sheets

Client: FPI | Job Number: 18-446 | Tracking #: 0016
Model: F3500 | Run Number: 1 | Test Date: 12/10/2018

Wood Heater Run Notes

Pre-Test Notes
Pre-Test Start Time: N/A – High-Fire
Air Control Setting: N/A – High-Fire

Time	Notes
N/A	N/A

Test Notes
Test Burn Start Time: 10:23
Air Control Setting: Fully Open – High-Fire Test

Time	Notes
0 min	Loaded 2.4 lbs of kindling and a couple pieces of printer paper, used propane torch for 20 seconds, door left cracked open
2 min	Closed bypass
3 min	@ 0.7 lbs remaining, added remaining kindling fuel (2.0 lbs), door still cracked
4 min	Door closed
9 min	@ 1.8lbs, added 3.4 lbs of start-up fuel
15 min	@ 4.2 lbs, added remaining start-up fuel (3 lbs)
35 min	@ 3.3 lbs, leveled coal bed, zeroed scale in preparation for fuel loading.
36 min	Loaded test fuel, fuel loaded in 35 seconds, door closed in 40 seconds.
56 min	Turned fan on high, per manufacturer's instructions.
60 min	Changed 1-hour filter
209 min	End of test

Test Burn End Time: 13:52

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO_2 (%): 16.93 CO (%): 4.330
Mid Gas CO_2 (%): 10.00 CO (%): 2.51

Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	9:38	9:45	9:42	14:32	14:30	14:35
CO_2	0.00	10.10	16.93	-0.03	10.04	16.90
CO	0.000	2.507	4.330	-0.028	2.469	4.287

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

Technician Signature:  Date: 12/10/2018

ASTM E3053 Wood Heater Run Sheets

Client: FPI | Job Number: 18-446 | Tracking #: 0016
Model: F3500 | Run Number: 1 | Test Date: 12/10/2018

Test Photos

Kindling Fuel Load

Start-up Fuel Load

High Fire Fuel Load

Residual Start-up Fuel Coal Bed

Technician Signature: _____ Date: 12/10/2018

ASTM E3053 Wood Heater Run Sheets

Client: FPI Job Number: 18-446 Tracking #: 0016
Model: F3500 Run Number: 1 Test Date: 12/10/2018

High Fire Fuel Loaded

Residual High Fire Load Coal Bed

N/A

Low/Medium Fire Fuel Load

N/A

Low/Medium Fire Fuel Loaded

Technician Signature: Date: 12/10/2018

WOOD STOVE TEST DATA PACKET
ASTM E3053/E2515

Run 2 Data Summary

Client:	FPI
Model:	F3500
Job #:	18-446
Tracking #:	0016
Test Date:	12/11/2018

12/18/2018

Techician Signature Date

TEST RESULTS - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

Burn Rate (kg/hr):	0.67

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft^3)	145.563	171.768	169.681	8.985
Average Gas Velocity in Dilution Tunnel (ft/sec)	13.60			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	9232.8			
Average Gas Meter Temperature (°F)	71.1	98.8	98.2	79.0
Total Sample Volume (dscf)	144.809	163.782	161.135	10.545
Average Tunnel Temperature (°F)	79.6			
Total Time of Test (min)	1140			
Total Particulate Catch (mg)	0.0	3.8	3.5	2.2
Particulate Concentration, dry-standard (g/dscf)	0.0000000	0.0000232	0.0000217	0.0002086
Total PM Emissions (g)	0.00	4.07	3.81	1.93
Particulate Emission Rate (g/hr)	0.00	0.21	0.20	1.93
Emissions Factor (g/kg)	-	0.32	0.30	-
Difference from Average Total Particulate Emissions (g)	-	0.13	0.13	-
Difference from Average Emissions Factor (g/kg)	-	0.01	0.01	-

Final Average Results	
Total Particulate Emissions (g)	3.94
Particulate Emission Rate (g/hr)	0.21
Emissions Factor (g/kg)	0.31
HHV Efficiency (%)	84.1%
LHV Efficiency (%)	89.9%
CO Emissions (g/min)	0.18

Quality Checks	Requirement	Observed	Result
Dual Train Precision	Each train within 7.5% of average emissions (in grams), or emission factors within 0.5 g/kg	See Above	OK
Filter Temps	>80 °F, <90 °F	Min: 83 / Max: 86	OK
Face Velocity	< 30 ft/min	8.3	OK
Leakage Rate	Less than 4% of average sample rate	0 cfm	OK
Ambient Temp	55-90 °F	Min: 68 / Max: 75	OK
Negative Probe Weight Evaluation	<5% of Total Catch	Probe Catch Not Negative	OK
Pro-Rate Variation	90% of readings between 90-110%; none greater than 120% or less than 80%	See Data Tabs	OK

B415.1 Efficiency Results

Manufacturer:	FPI
Model:	F3500
Date:	12/11/18
Run:	2
Control #:	18-446
Test Duration:	1140
Output Category:	Low

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	84.1%	89.9%
Combustion Efficiency	99.0%	99.0%
Heat Transfer Efficiency	84.9%	90.8%

Output Rate (kJ/h)	11,284	10,704	**(Btu/h)**
Burn Rate (kg/h)	0.67	1.48	**(lb/h)**
Input (kJ/h)	13,422	12,732	**(Btu/h)**

Test Load Weight (dry kg)	12.78	28.16	**dry lb**
MC wet (%)	18.85		
MC dry (%)	23.23		
Particulate (g)	3.94		
CO (g)	200		
Test Duration (h)	19.00		

Emissions	**Particulate**	**CO**
g/MJ Output	0.02	0.93
g/kg Dry Fuel	0.31	15.63
g/h	0.21	10.51
g/min	0.00	0.18
lb/MM Btu Output	0.04	2.16

Air/Fuel Ratio (A/F)	10.72

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

HIGH FIRE FUEL LOAD DATA - ASTM E3053

Client: FPI
Job #: 18-446
Model: F3500
Tracking # 0016
Run #: 2
Technician: SJB
Date: 12/11/2018

Nominal Loading Density (lbs/ft^3, wet basis):	10		
Usable Firebox Volume (ft^3):	3.04		
Target Load Weight (lbs):	30.40		
Total Load Weight Range (lbs):	28.90	to	31.90
Core Load Weight Range (lbs):	13.70	to	19.80
Remainder Load Weight Range (lbs):	10.60	to	16.70
Core Load Piece Range (lbs):	4.60	to	7.60
Remainder Load Piece Range (lbs):	3.00	to	16.70
Max Allowable Kindling Weight (lbs):	5.99		
Max Allowable Start-up Fuel Weight (lbs):	8.99		

CORE LOAD DATA

				Fuel Piece Moisture Readings (%DB)					Dry Weight	
Piece #	Length (in)	Weight (lbs)	Within Spec?	1	2	3	Ave.	Within Spec?	lbs	kg
1	17	5.31	In Range	21.9	22.4	25.2	23.2	In Range	4.31	1.96
2	17	6.15	In Range	23.7	25.4	24.7	24.6	In Range	4.94	2.24
3	17	4.92	In Range	19.7	20.9	20.8	20.5	In Range	4.08	1.85
Core Load Wt. (lbs)		16.38	In Range							

REMAINDER LOAD DATA (1 to 3 Pieces)

				Fuel Piece Moisture Readings (%DB)					Dry Weight	
Piece #	Length (in)	Weight (lbs)	Within Spec?	1	2	3	Ave.	Within Spec?	lbs	kg
1	17	3.51	In Range	24.3	23.0	24.9	24.1	In Range	2.83	1.28
2	17	6.17	In Range	23.4	22.9	25.3	23.9	In Range	4.98	2.26
3	17	3.90	In Range	20.6	22.9	22.7	22.1	In Range	3.19	1.45
Remainder Load (lbs)		13.58	In Range							

Total Load Weight (lbs):	29.96	In Range	
Core Load % of Total Weight:	55%	In Range	45-65%
Remainder % of Total Weight:	45%	In Range	35-55%
Total Load % of Target Weight:	99%	In Range	95-105%
Actual Fuel Loading Density (lb/ft3):	9.9		
Total Load Average Moisture Conent (%DB):	23.1	In Range	19-25%
Total Load Average Moisture Conent (%WB):	18.8		
Total Test Load Weight (dry basis):	24.34 lbs	11.04 kg	

KINDLING AND START-UP FUEL

		Kindling Moisture Readings (%DB)					Dry Weight	
Kindling Weight (lbs)	Within Spec?	1	2	3	Avg.	Within Spec?	lbs	kg
4.43	In Range	10	10	10	10.0	In Range	4.03	1.83

		Start-up Moisture Readings (%DB)					Dry Weight	
Start-up Fuel Wt. (lb)	Within Spec?	1	2	3	Avg.	Within Spec?	lbs	kg
6.44	In Range	23.4	22.8	19.6	21.9	In Range	5.28	2.40

TEST FUEL LOADING RANGE

Allowable Residual Start-up Fuel Range (lb):	3.0	to	6.0	
Actual Residual Start-up Fuel Weight (lb):	3.3			In Range

LOW & MEDIUM FIRE FUEL LOAD DATA - ASTM E3053

Client: FPI
Job #: 18-446
Model: F3500
Tracking #: 0016
Run #: 2
Technician: SJB
Date: 12/11/2018

Nominal Loading Density (lbs/ft^3, wet basis):	12		
Usable Firebox Volume (ft^3):	3.04		
Target Load Weight (lbs):	36.48		
Total Load Weight Range (lbs):	34.66	to	38.30
Core Load Weight Range (lbs):	16.42	to	23.71
Remainder Load Weight Range (lbs):	12.77	to	20.06
Core Load Piece Range (lbs):	5.47	to	9.12
Remainder Load Piece Range (lbs):	3.65	to	7.30

CORE LOAD DATA

				Fuel Piece Moisture Readings (%DB)					Dry Weight	
Piece #	Length (in)	Weight (lbs)	Within Spec?	1	2	3	Ave.	Within Spec?	lbs	kg
1	17	5.97	In Range	24.9	23.2	23.1	23.7	In Range	4.82	2.19
2	17	7.14	In Range	24.9	22.9	26.1	24.6	In Range	5.73	2.60
3	17	5.95	In Range	19.3	23.6	21.7	21.5	In Range	4.90	2.22
Core Load Wt. (lbs)		19.06	In Range							

REMAINDER LOAD DATA (3 to 4 Pieces)

				Fuel Piece Moisture Readings (%DB)					Dry Weight	
Piece #	Length (in)	Weight (lbs)	Within Spec?	1	2	3	Ave.	Within Spec?	lbs	kg
1	17	4.01	In Range	18.4	19.2	20.4	19.3	In Range	3.36	1.52
2	17	5.40	In Range	23.5	23.4	23.9	23.6	In Range	4.37	1.98
3	17	6.83	In Range	24.9	25.2	24.7	24.9	In Range	5.47	2.48
4			NA				NA	NA	NA	NA
Remainder Load (lbs)		16.24	In Range							

Remainder Load Small/Large Piece Weight Ratio:	59%	In Range	≤ 67%
Total Load Weight (lbs):	35.30	In Range	
Core Load % of Total Weight:	54%	In Range	45-65%
Remainder % of Total Weight:	46%	In Range	35-55%
Total Load % of Target Weight:	97%	In Range	95-105%
Actual Fuel Loading Density (lb/ft3):	11.6		
Total Load Average Moisture Conent (%DB):	23.2	In Range	19-25%
Total Load Average Moisture Conent (%WB):	18.9		
Total Test Load Weight (dry basis):	28.65 lbs	12.99 kg	

TEST FUEL LOADING RANGE

Allowable Charcoal Bed Weight Range (lb):	3.6	to	7.0	
Actual Charcoal Bed Wt. (lb):		4.6		In Range

TEST END POINT

Actual Fuel Load Ending Weight (lb): 0.5 Valid Test (≥90%)

Total Fuel Burned During Test Run:	34.8	lbs, wet basis
	28.1	lbs, dry basis
	12.77	kg, dry basis

DILUTION TUNNEL & MISC. DATA - ASTM E3053 / E2515

Client:	FPI	Job #:	18-446
Model:	F3500	Tracking #:	0016
Run #:	2	Technician:	SJB
Test Start Time:	13:53	Date:	12/11/2018
Test Type:	Low Fire		

Recording Interval (min):	5
Total Sampling Time (min):	1140

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	29.72	30.24	29.98
Relative Humidity (%)	31.3	24.6	
Room Air Velocity (ft/min)	0	0	
Scale Audit (lbs)	10.0	10.0	

Meter Box γ Factor:	1.002	(A)	
Meter Box γ Factor:	0.997	(B)	
Meter Box γ Factor:	0.999	(Ambient)	
Ambient Sample Volume:	145.563	ft^3	

Induced Draft Check (in. H_2O):	0
Smoke Capture Check (%):	100%
Date Flue Pipe Last Cleaned:	12/7/2018

Sample Train Post-Test Leak Checks

(A)	0.000	cfm @	-14	in. Hg
(B)	0.000	cfm @	-15	in. Hg
(Ambient)	0.001	cfm @	-14	in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H_2O)	Temp (°F)
1	0.038	119
2	0.046	119
3	0.042	118
4	0.034	117
5	0.038	117
6	0.044	117
7	0.048	116
8	0.034	116
Center	0.050	119

Static Pressure: -0.160 in. H_2O

Dilution Tunnel H_2O:	2.00	percent
Tunnel Diameter:	6	inches
Pitot Tube Cp:	0.99	[unitless]
Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Tunnel Area:	0.1963	ft^2
V_{strav}:	14.15	ft/sec
V_{scent}:	15.57	ft/sec
F_p:	0.908	[ratio]
Initial Tunnel Flow:	147.1	scf/min

TEST FUEL PROPERTIES

ASTM 3053-17 - Table A1.1 Fuel Properties by Fuel Species

Select Fuel Type	Species	%C	%H	%O	%Ash	MJ/kg	BTU/lb
	Ash, White	49.70	6.90	43.00	0.30	20.75	8927
	Beech	48.70	5.80	44.70	0.60	18.80	8088
	Birch, Sweet	49.80	6.50	43.40	0.30	20.12	8656
	Birch, Yellow	49.80	6.50	43.40	0.30	20.12	8656
	Doug Fir (Coast, Interior West/North)	48.73	6.87	43.90	0.50	19.81	8522
	Doug Fir (Interioir South)	48.73	6.87	43.90	0.50	19.81	8522
	Elm, Rock	50.40	6.60	42.30	0.70	20.49	8815
	Elm, Soft	50.40	6.60	42.30	0.70	20.49	8815
	Gum, Red	50.88	6.06	41.57	1.28	19.72	8478
	Larch, Western	50.54	6.36	42.40	0.70	17.58	7558
X	Maple, Hard	50.64	6.02	41.74	1.35	19.96	8587
	Maple, Sugar	50.64	6.02	41.74	1.35	19.96	8587
	Oak, Red	49.50	6.62	43.70	0.20	20.20	8690
	Oak, White	50.40	6.59	42.70	0.20	20.50	8819
	Pine, Southern	52.60	7.00	40.10	1.31	22.30	9587
	Pine, Southern Long Leaf	52.60	7.02	40.10	1.30	22.30	9594
	Other						

WOODSTOVE PREBURN DATA

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

Recording Interval (min): 5
Run Time (min): 205

			Temperatures (°F)							
Elapsed Time (min)	**Scale Reading (lbs)**	**Flue Draft (in H_2O)**	**FB Left**	**FB Right**	**FB Back**	**FB Top**	**FB Bottom**	**Stove Surface Average**	**Flue**	**Ambient**
0	2.4	0.011	66	66	66	67	66	66.2	67	64
5	3.0	-0.053	92	82	89	101	66	86.0	367	64
10	3.9	-0.066	130	112	128	195	76	128.2	407	64
15	3.2	-0.082	158	145	159	319	93	174.8	472	64
20	6.4	-0.077	189	183	193	405	111	216.2	525	65
25	5.4	-0.085	223	217	224	491	127	256.4	531	65
30	4.5	-0.070	256	267	262	544	142	294.2	565	65
35	3.6	-0.078	304	303	304	545	155	322.2	508	66
40	32.7	-0.076	352	331	344	544	168	347.8	610	66
45	31.6	-0.075	356	337	350	557	179	355.8	552	66
50	30.5	-0.068	349	339	345	592	189	362.8	570	67
55	29.4	-0.084	345	340	341	594	197	363.4	582	66
60	28.3	-0.084	345	344	348	571	205	362.6	577	66
65	27.2	-0.089	349	355	351	566	213	366.8	568	66
70	26.0	-0.088	355	370	352	564	221	372.4	569	66
75	24.9	-0.077	363	381	357	578	228	381.4	567	66
80	23.8	-0.084	374	387	365	578	236	388.0	565	66
85	22.8	-0.089	388	392	375	581	245	396.2	561	65
90	21.7	-0.081	401	398	385	579	254	403.4	559	65
95	20.7	-0.077	413	404	395	581	264	411.4	560	65
100	19.8	-0.080	426	409	405	587	273	420.0	563	65
105	18.7	-0.083	436	415	416	591	283	428.2	563	65
110	17.6	-0.082	447	423	427	580	293	434.0	560	65
115	16.5	-0.085	457	433	436	590	303	443.8	557	65
120	15.5	-0.076	465	442	445	592	313	451.4	553	65
125	14.6	-0.085	475	451	455	580	323	456.8	552	65
130	13.7	-0.078	482	461	462	593	332	466.0	549	66
135	12.9	-0.085	484	472	470	594	340	472.0	548	66
140	12.0	-0.070	483	482	476	591	348	476.0	545	66
145	11.1	-0.087	481	491	484	583	357	479.2	549	66
150	10.3	-0.087	481	499	495	593	366	486.8	541	65
155	9.5	-0.090	480	506	502	580	374	488.4	532	66
160	8.6	-0.083	481	513	507	578	382	492.2	600	66
165	7.6	-0.075	483	517	512	571	389	494.4	530	66
170	7.1	-0.079	482	526	516	567	388	495.8	519	66
175	6.4	-0.080	481	528	523	560	385	495.4	514	66
180	5.8	-0.073	482	522	529	580	379	498.4	500	66
185	5.4	-0.073	484	517	535	550	373	491.8	480	66
190	5.2	-0.060	483	510	538	519	367	483.4	458	66
195	5.0	-0.070	477	501	536	491	363	473.6	442	66
200	4.8	-0.077	468	490	532	459	359	461.6	433	66
205	4.6	-0.059	460	478	524	438	356	451.2	425	66

BOX A TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.050	0.01	76	0		35.2		115	451	84	75
5	0.731	0.146	0.050	2.25	76	0	105	34.4	-0.8	121	474	83	74
10	1.461	0.146	0.050	2.21	77	-0.42	105	33.2	-1.2	124	552	84	75
15	2.188	0.145	0.050	2.14	78	-2.53	105	31.9	-1.3	129	577	85	75
20	2.929	0.148	0.050	2.33	80	-0.2	104	31.4	-0.5	107	336	85	75
25	3.684	0.151	0.050	2.33	82	-2.07	105	30.9	-0.5	97	307	84	75
30	4.437	0.151	0.050	2.31	84	-2.77	104	30.4	-0.5	95	302	83	75
35	5.192	0.151	0.050	2.33	85	-0.23	104	30.0	-0.4	93	300	84	73
40	5.951	0.152	0.050	2.32	87	-0.38	104	29.5	-0.5	92	301	86	72
45	6.709	0.152	0.050	2.31	89	-2.18	104	28.9	-0.6	92	305	85	72
50	7.464	0.151	0.050	2.32	90	-1.93	103	28.4	-0.5	91	298	84	73
55	8.223	0.152	0.050	2.31	91	-2.56	103	27.9	-0.5	90	288	84	72
60	8.985	0.152	0.050	2.31	92	-0.31	103	27.5	-0.4	89	287	84	72
65	9.763	0.156	0.050	2.34	93	-0.01	105	27.0	-0.5	89	290	83	72
70	10.528	0.153	0.050	2.33	94	-1.22	103	26.5	-0.5	89	292	83	72
75	11.293	0.153	0.050	2.32	95	-0.23	103	26.1	-0.4	89	291	84	71
80	12.056	0.153	0.050	2.33	95	-0.3	103	25.6	-0.5	88	279	85	71
85	12.819	0.153	0.050	2.31	96	-1.4	102	25.2	-0.4	87	274	86	72
90	13.585	0.153	0.050	2.31	96	-0.76	103	24.8	-0.4	87	273	86	72
95	14.352	0.153	0.050	2.31	97	-1.63	103	24.4	-0.4	87	274	85	72
100	15.115	0.153	0.050	2.30	97	-2.23	102	24.1	-0.3	86	272	84	72
105	15.878	0.153	0.050	2.31	97	-0.17	102	23.7	-0.4	86	270	83	73
110	16.642	0.153	0.050	2.30	98	-0.2	102	23.3	-0.4	86	269	83	73
115	17.407	0.153	0.050	2.31	98	0	102	22.9	-0.4	86	273	83	73
120	18.172	0.153	0.050	2.33	98	-0.87	102	22.6	-0.3	86	270	84	73
125	18.939	0.153	0.050	2.29	98	-0.01	102	22.3	-0.3	85	266	85	73
130	19.703	0.153	0.050	2.30	99	0	102	21.9	-0.4	85	263	86	73
135	20.463	0.152	0.050	2.26	99	-2.46	101	21.6	-0.3	85	261	86	73
140	21.225	0.152	0.050	2.28	99	-2.25	102	21.2	-0.4	85	259	84	73
145	21.991	0.153	0.050	2.29	99	0	102	21.0	-0.2	85	258	84	73
150	22.755	0.153	0.050	2.27	100	-2.69	102	20.7	-0.3	84	257	83	73
155	23.517	0.152	0.050	2.28	100	-1.97	101	20.3	-0.4	84	257	83	73
160	24.277	0.152	0.050	2.28	100	-0.15	101	20.3	0	84	255	83	73

BOX A TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
165	25.037	0.152	0.050	2.27	100	-0.06	101	19.9	-0.4	84	255	84	73
170	25.801	0.153	0.050	2.26	100	-0.38	102	19.6	-0.3	84	256	85	73
175	26.563	0.152	0.050	2.28	100	-0.76	101	19.4	-0.2	84	258	86	72
180	27.322	0.152	0.050	2.28	101	-2.59	101	19.0	-0.4	84	257	85	72
185	28.081	0.152	0.050	2.26	101	-2.68	101	18.7	-0.3	83	252	83	72
190	28.840	0.152	0.050	2.27	101	-0.48	101	18.4	-0.3	83	248	83	73
195	29.601	0.152	0.050	2.26	101	-0.24	101	18.2	-0.2	83	245	83	72
200	30.360	0.152	0.050	2.24	101	-1.06	101	17.9	-0.3	83	241	84	72
205	31.118	0.152	0.050	2.26	101	-1.85	100	17.7	-0.2	82	237	85	72
210	31.875	0.151	0.050	2.25	101	-0.4	100	17.5	-0.2	82	236	86	72
215	32.636	0.152	0.050	2.25	101	-2.44	101	17.2	-0.3	82	233	86	72
220	33.395	0.152	0.050	2.25	101	-2.39	101	17.0	-0.2	82	233	84	72
225	34.152	0.151	0.050	2.24	101	-2.13	100	16.8	-0.2	82	231	83	72
230	34.909	0.151	0.050	2.22	101	-0.11	100	16.6	-0.2	81	230	83	72
235	35.668	0.152	0.050	2.23	101	-0.08	100	16.4	-0.2	81	229	83	72
240	36.427	0.152	0.050	2.24	101	-2.14	100	16.1	-0.3	81	228	85	72
245	37.183	0.151	0.050	2.23	101	-2.55	100	15.9	-0.2	81	228	86	72
250	37.939	0.151	0.050	2.24	101	-0.16	100	15.6	-0.3	81	230	85	72
255	38.697	0.152	0.050	2.22	101	-1.99	100	15.4	-0.2	81	232	84	72
260	39.455	0.152	0.050	2.24	101	-0.94	100	15.1	-0.3	81	234	83	72
265	40.209	0.151	0.050	2.23	101	-1.89	100	14.9	-0.2	81	235	83	72
270	40.965	0.151	0.050	2.23	101	-1.8	100	14.6	-0.3	81	236	83	72
275	41.723	0.152	0.050	2.23	101	-0.15	100	14.4	-0.2	81	237	84	72
280	42.479	0.151	0.050	2.25	101	-1.44	100	14.1	-0.3	81	238	85	72
285	43.232	0.151	0.050	2.23	101	-1.33	100	13.9	-0.2	81	237	86	72
290	43.988	0.151	0.050	2.23	101	-0.88	100	13.6	-0.3	81	235	85	72
295	44.746	0.152	0.050	2.24	101	-0.44	100	13.4	-0.2	81	236	84	72
300	45.501	0.151	0.050	2.23	101	-0.1	100	13.2	-0.2	81	234	83	72
305	46.253	0.150	0.050	2.24	101	-2.55	100	12.9	-0.3	81	235	83	72
310	47.009	0.151	0.050	2.24	101	-2.54	100	12.7	-0.2	81	234	83	72
315	47.765	0.151	0.050	2.22	101	-0.24	100	12.3	-0.4	81	235	84	72
320	48.517	0.150	0.050	2.22	101	-0.73	100	12.2	-0.1	81	235	85	72
325	49.270	0.151	0.050	2.22	101	-0.03	100	11.9	-0.3	81	236	86	72

BOX A TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
330	50.026	0.151	0.050	2.24	101	-2.63	100	11.7	-0.2	81	238	86	72
335	50.781	0.151	0.050	2.21	101	-2.67	100	11.3	-0.4	81	240	85	72
340	51.532	0.150	0.050	2.21	101	-0.04	99	11.1	-0.2	81	241	84	72
345	52.286	0.151	0.050	2.20	101	-1.03	100	10.9	-0.2	81	240	83	72
350	53.040	0.151	0.050	2.22	101	-2.31	100	10.7	-0.2	81	238	83	72
355	53.791	0.150	0.050	2.23	101	-2.32	99	10.5	-0.2	81	231	83	72
360	54.544	0.151	0.050	2.23	101	-0.52	100	10.3	-0.2	81	226	84	72
365	55.300	0.151	0.050	2.21	101	-2.45	100	10.1	-0.2	81	220	86	72
370	56.051	0.150	0.050	2.22	101	-2.68	99	10.0	-0.1	81	214	86	72
375	56.801	0.150	0.050	2.22	101	-2	99	9.8	-0.2	80	209	85	72
380	57.555	0.151	0.050	2.22	101	-1.32	100	9.6	-0.2	80	206	84	72
385	58.309	0.151	0.050	2.23	101	-0.84	100	9.6	0	80	202	83	72
390	59.060	0.150	0.050	2.21	101	-0.33	99	9.5	-0.1	80	200	83	72
395	59.813	0.151	0.050	2.21	101	-1.91	100	9.3	-0.2	80	198	84	72
400	60.566	0.151	0.050	2.22	101	-2.58	100	9.1	-0.2	80	196	85	72
405	61.316	0.150	0.050	2.22	101	-0.14	99	9.1	0	79	195	86	71
410	62.068	0.150	0.050	2.23	101	-0.22	99	8.9	-0.2	79	195	86	72
415	62.823	0.151	0.050	2.21	101	-0.22	100	8.8	-0.1	79	193	85	72
420	63.574	0.150	0.050	2.23	101	-0.17	99	8.6	-0.2	79	193	84	71
425	64.322	0.150	0.050	2.22	101	-0.36	99	8.5	-0.1	79	191	83	72
430	65.076	0.151	0.050	2.22	101	-0.12	100	8.4	-0.1	79	189	83	72
435	65.829	0.151	0.050	2.19	101	-2.32	100	8.3	-0.1	79	186	83	71
440	66.576	0.149	0.050	2.22	101	-0.28	99	8.2	-0.1	78	183	84	71
445	67.328	0.150	0.050	2.22	101	-0.26	99	8.1	-0.1	78	180	85	71
450	68.081	0.151	0.050	2.23	101	-0.18	99	8.0	-0.1	78	175	85	71
455	68.829	0.150	0.050	2.20	101	-0.38	99	8.0	0	78	171	86	71
460	69.581	0.150	0.050	2.23	101	-2.49	99	7.9	-0.1	78	168	84	71
465	70.334	0.151	0.050	2.22	101	-0.2	99	7.8	-0.1	77	166	84	71
470	71.083	0.150	0.050	2.22	100	-2.8	99	7.7	-0.1	78	165	83	71
475	71.834	0.150	0.050	2.23	100	-0.95	99	7.6	-0.1	77	165	83	71
480	72.587	0.151	0.050	2.22	100	-0.86	99	7.5	-0.1	77	165	83	71
485	73.336	0.150	0.050	2.23	100	-2.73	99	7.3	-0.2	77	165	84	71
490	74.087	0.150	0.050	2.23	100	-0.78	99	7.3	0	77	163	85	71

BOX A TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
495	74.841	0.151	0.050	2.22	100	-1.66	100	7.3	0	77	163	86	71
500	75.589	0.150	0.050	2.22	100	-2.56	99	7.2	-0.1	77	162	86	71
505	76.340	0.150	0.050	2.24	100	-0.75	99	7.1	-0.1	77	162	85	71
510	77.094	0.151	0.050	2.22	100	-0.25	100	7.0	-0.1	77	162	84	71
515	77.845	0.150	0.050	2.22	100	-2.24	99	6.9	-0.1	77	161	83	71
520	78.593	0.150	0.050	2.21	100	-2.56	99	6.9	0	77	160	83	71
525	79.347	0.151	0.050	2.24	100	-2.6	100	6.7	-0.2	77	159	84	71
530	80.100	0.151	0.050	2.21	100	-1.65	99	6.7	0	76	159	85	71
535	80.848	0.150	0.050	2.22	100	-2.18	99	6.7	0	77	158	86	71
540	81.600	0.150	0.050	2.21	100	-2.32	99	6.7	0	77	156	85	71
545	82.353	0.151	0.050	2.24	100	-1.03	99	6.5	-0.2	77	155	85	71
550	83.102	0.150	0.050	2.21	100	-0.18	99	6.5	0	77	154	83	71
555	83.854	0.150	0.050	2.23	100	-2.71	99	6.4	-0.1	77	154	83	71
560	84.606	0.150	0.050	2.21	100	-0.17	99	6.2	-0.2	77	154	84	71
565	85.356	0.150	0.050	2.24	100	-2.77	99	6.2	0	77	154	85	71
570	86.107	0.150	0.050	2.23	100	-2.79	99	6.1	-0.1	77	154	85	71
575	86.861	0.151	0.050	2.23	100	-1.85	100	6.0	-0.1	77	153	86	71
580	87.609	0.150	0.050	2.22	100	-1.12	99	6.0	0	77	154	85	71
585	88.360	0.150	0.050	2.24	100	-0.21	99	6.0	0	77	153	84	71
590	89.114	0.151	0.050	2.23	100	-0.85	100	5.8	-0.2	77	153	83	71
595	89.864	0.150	0.050	2.24	100	-2.43	99	5.7	-0.1	76	152	83	71
600	90.611	0.149	0.050	2.23	100	-0.65	99	5.8	0.1	77	151	84	71
605	91.365	0.151	0.050	2.24	100	-2.59	100	5.7	-0.1	76	150	85	71
610	92.118	0.151	0.050	2.21	100	-0.86	99	5.6	-0.1	77	150	86	71
615	92.866	0.150	0.050	2.23	100	-0.5	99	5.6	0	76	149	85	71
620	93.618	0.150	0.050	2.23	100	-1.27	99	5.4	-0.2	77	148	85	71
625	94.371	0.151	0.050	2.24	100	-2.67	99	5.4	0	76	147	84	71
630	95.120	0.150	0.050	2.21	100	-0.07	99	5.4	0	77	146	83	71
635	95.872	0.150	0.050	2.21	100	-0.13	99	5.3	-0.1	76	146	83	71
640	96.624	0.150	0.050	2.23	100	-1.06	99	5.3	0	76	145	84	71
645	97.374	0.150	0.050	2.24	100	-1.98	99	5.2	-0.1	76	145	84	71
650	98.126	0.150	0.050	2.23	100	-2.48	99	5.2	0	76	144	86	71
655	98.880	0.151	0.050	2.24	100	-0.52	100	5.1	-0.1	76	144	85	71

BOX A TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
660	99.628	0.150	0.050	2.23	100	-1.45	99	5.1	0	76	144	85	71
665	100.379	0.150	0.050	2.23	100	-2.53	99	5.0	-0.1	76	143	84	71
670	101.134	0.151	0.050	2.24	100	-0.11	100	5.0	0	76	144	83	71
675	101.885	0.150	0.050	2.24	100	-2.79	99	4.9	-0.1	76	143	83	71
680	102.633	0.150	0.050	2.24	100	-1.51	99	4.8	-0.1	76	143	84	71
685	103.387	0.151	0.050	2.22	100	-2.08	100	4.8	0	76	143	84	71
690	104.140	0.151	0.050	2.24	100	-0.62	99	4.8	0	76	143	85	71
695	104.889	0.150	0.050	2.23	100	-1.45	99	4.7	-0.1	76	142	86	71
700	105.641	0.150	0.050	2.24	100	-0.72	99	4.6	-0.1	76	143	86	70
705	106.394	0.151	0.050	2.24	100	-2.75	99	4.6	0	76	142	85	71
710	107.144	0.150	0.050	2.24	100	-1.7	99	4.5	-0.1	76	142	84	70
715	107.896	0.150	0.050	2.24	100	-1.96	99	4.4	-0.1	76	142	83	71
720	108.648	0.150	0.050	2.23	100	-2.52	99	4.4	0	76	142	83	70
725	109.398	0.150	0.050	2.24	100	-2.36	99	4.4	0	76	141	85	71
730	110.149	0.150	0.050	2.23	100	-0.78	99	4.3	-0.1	76	142	85	70
735	110.903	0.151	0.050	2.23	100	-0.81	99	4.3	0	75	142	85	71
740	111.653	0.150	0.050	2.23	100	-1.22	99	4.2	-0.1	76	141	85	71
745	112.402	0.150	0.050	2.24	100	-2.66	99	4.2	0	75	141	83	70
750	113.157	0.151	0.050	2.26	100	-2.5	100	4.1	-0.1	76	141	83	71
755	113.909	0.150	0.050	2.23	100	0	99	4.1	0	75	141	83	70
760	114.658	0.150	0.050	2.24	100	-0.09	99	3.9	-0.2	76	141	83	70
765	115.411	0.151	0.050	2.24	100	-1.55	99	4.0	0.1	75	140	84	71
770	116.164	0.151	0.050	2.25	100	-1.43	99	3.9	-0.1	76	141	85	70
775	116.914	0.150	0.050	2.21	100	-1.38	99	3.9	0	76	141	86	71
780	117.666	0.150	0.050	2.23	100	-0.17	99	3.8	-0.1	76	141	85	70
785	118.418	0.150	0.050	2.24	100	-1.56	99	3.7	-0.1	76	140	84	71
790	119.167	0.150	0.050	2.23	100	-2.35	99	3.6	-0.1	76	141	83	70
795	119.920	0.151	0.050	2.24	100	-0.71	99	3.6	0	76	141	83	71
800	120.672	0.150	0.050	2.25	100	-2.69	99	3.6	0	75	140	84	70
805	121.420	0.150	0.050	2.24	100	-1.37	99	3.5	-0.1	76	140	86	71
810	122.171	0.150	0.050	2.25	100	-2.68	99	3.5	0	75	140	85	70
815	122.926	0.151	0.050	2.21	100	-0.34	100	3.4	-0.1	76	140	85	70
820	123.676	0.150	0.050	2.24	100	-2.22	99	3.4	0	75	140	84	70

BOX A TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
825	124.425	0.150	0.050	2.25	100	-0.21	99	3.3	-0.1	76	140	83	70
830	125.179	0.151	0.050	2.23	100	-2.79	99	3.3	0	75	140	83	70
835	125.933	0.151	0.050	2.24	99	-2.72	100	3.2	-0.1	76	140	84	70
840	126.682	0.150	0.050	2.23	100	-2.64	99	3.2	0	75	140	85	70
845	127.434	0.150	0.050	2.25	99	-1.2	99	3.1	-0.1	76	140	86	70
850	128.188	0.151	0.050	2.25	99	-1.77	100	3.1	0	75	141	85	70
855	128.938	0.150	0.050	2.26	99	-2.6	99	3.0	-0.1	75	140	84	70
860	129.691	0.151	0.050	2.22	99	-0.05	99	3.0	0	75	140	83	70
865	130.445	0.151	0.050	2.24	99	-2.73	100	2.9	-0.1	75	139	83	70
870	131.194	0.150	0.050	2.25	99	-2.08	99	2.9	0	75	139	84	70
875	131.945	0.150	0.050	2.21	99	-1.4	99	2.9	0	75	139	85	70
880	132.701	0.151	0.050	2.23	99	-0.2	100	2.8	-0.1	75	138	86	70
885	133.452	0.150	0.050	2.25	99	-2.49	99	2.7	-0.1	75	138	86	70
890	134.202	0.150	0.050	2.25	99	-0.38	99	2.7	0	75	138	86	70
895	134.955	0.151	0.050	2.25	99	-0.38	99	2.8	0.1	75	138	84	70
900	135.708	0.151	0.050	2.24	99	-1.13	100	2.6	-0.2	76	137	83	70
905	136.458	0.150	0.050	2.24	99	-1.88	99	2.6	0	76	136	83	70
910	137.211	0.151	0.050	2.24	99	-0.17	99	2.5	-0.1	75	137	83	70
915	137.963	0.150	0.050	2.26	99	-1.19	99	2.5	0	76	137	85	70
920	138.713	0.150	0.050	2.23	99	-0.14	99	2.4	-0.1	75	136	86	70
925	139.466	0.151	0.050	2.25	99	-1.24	99	2.4	0	75	136	86	70
930	140.220	0.151	0.050	2.24	99	-2.68	100	2.3	-0.1	75	136	85	70
935	140.969	0.150	0.050	2.25	99	-1.2	99	2.3	0	75	136	84	70
940	141.720	0.150	0.050	2.26	99	-1.01	99	2.3	0	75	136	83	70
945	142.475	0.151	0.050	2.26	99	-1.87	100	2.2	-0.1	75	136	83	70
950	143.227	0.150	0.050	2.25	99	-1.28	99	2.2	0	75	136	83	70
955	143.976	0.150	0.050	2.24	99	-1.26	99	2.1	-0.1	76	135	85	70
960	144.729	0.151	0.050	2.25	99	-0.09	99	2.1	0	75	136	85	70
965	145.482	0.151	0.050	2.27	99	-2.82	99	2.0	-0.1	75	135	86	70
970	146.232	0.150	0.050	2.21	99	-1.06	99	2.0	0	75	135	86	70
975	146.983	0.150	0.050	2.25	99	-0.23	99	2.0	0	75	135	84	70
980	147.735	0.150	0.050	2.25	99	-1.07	99	1.8	-0.2	75	133	83	70
985	148.485	0.150	0.050	2.24	99	-0.16	99	1.9	0.1	75	133	83	70

BOX A TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
990	149.237	0.150	0.050	2.23	99	-0.09	99	1.8	-0.1	75	133	84	70
995	149.991	0.151	0.050	2.24	99	-0.11	100	1.8	0	75	132	85	70
1000	150.739	0.150	0.050	2.24	99	-2.79	99	1.8	0	75	132	85	70
1005	151.490	0.150	0.050	2.25	99	-0.25	99	1.7	-0.1	75	132	86	70
1010	152.245	0.151	0.050	2.24	99	-0.6	100	1.7	0	75	130	85	70
1015	152.996	0.150	0.050	2.24	99	-0.45	99	1.6	-0.1	75	131	84	70
1020	153.744	0.150	0.050	2.26	99	-2.86	99	1.6	0	76	130	83	70
1025	154.498	0.151	0.050	2.24	99	-0.32	100	1.6	0	75	130	83	70
1030	155.251	0.151	0.050	2.26	99	-0.29	99	1.5	-0.1	75	130	84	70
1035	156.000	0.150	0.050	2.26	99	-0.66	99	1.4	-0.1	77	163	85	70
1040	156.752	0.150	0.050	2.25	99	-0.1	99	1.3	-0.1	76	137	86	70
1045	157.505	0.151	0.050	2.26	99	-2.38	100	1.3	0	76	135	86	70
1050	158.254	0.150	0.050	2.23	99	-0.79	99	1.2	-0.1	75	139	85	69
1055	159.006	0.150	0.050	2.24	99	-0.57	99	1.0	-0.2	76	140	84	69
1060	159.757	0.150	0.050	2.25	99	-0.2	99	1.0	0	76	140	83	69
1065	160.505	0.150	0.050	2.23	99	-1.23	99	1.0	0	76	138	84	69
1070	161.257	0.150	0.050	2.22	99	-2.44	99	1.0	0	76	135	85	69
1075	162.010	0.151	0.050	2.25	99	-2.39	100	0.9	-0.1	76	133	86	69
1080	162.758	0.150	0.050	2.23	99	-0.26	99	0.9	0	76	130	86	69
1085	163.509	0.150	0.050	2.26	99	-2.78	99	1.0	0.1	75	128	85	68
1090	164.262	0.151	0.050	2.26	99	-0.24	100	0.8	-0.2	76	127	84	69
1095	165.010	0.150	0.050	2.24	99	-1.95	99	0.8	0	75	126	84	69
1100	165.760	0.150	0.050	2.25	98	-0.2	99	0.8	0	75	125	84	69
1105	166.514	0.151	0.050	2.26	98	-1.94	100	0.7	-0.1	75	123	85	69
1110	167.263	0.150	0.050	2.26	98	-2.47	99	0.7	0	75	123	86	68
1115	168.011	0.150	0.050	2.24	98	-1.74	99	0.7	0	75	121	86	68
1120	168.764	0.151	0.050	2.26	98	-0.74	100	0.6	-0.1	75	120	85	68
1125	169.515	0.150	0.050	2.25	98	-0.69	99	0.6	0	75	120	84	68
1130	170.263	0.150	0.050	2.25	98	-0.17	99	0.6	0	75	118	83	68
1135	171.015	0.150	0.050	2.27	98	-0.2	100	0.6	0	75	118	84	68
1140	171.768	0.151	0.050	2.25	98	-1.06	100	0.5	-0.1	75	116	85	69
Avg/Tot	171.768	0.151	0.050	2.23	99	-1.28	100			80	187	84	71.1

BOX B TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
0	0.000		0.00	75	-1		85	0.000	6.17	0.09
5	0.699	0.140	2.14	75	-2.5	102	86	-0.080	17.52	0.45
10	1.406	0.141	2.17	76	-0.89	103	85	-0.080	18.74	1.83
15	2.120	0.143	2.15	77	-2.93	104	85	-0.080	18.67	3.69
20	2.836	0.143	2.14	79	-2.61	102	86	-0.060	10.89	0.00
25	3.556	0.144	2.13	81	-2.35	101	86	-0.050	12.26	0.00
30	4.271	0.143	2.13	83	-1.49	100	85	-0.060	13.18	0.03
35	4.992	0.144	2.14	85	-2.96	100	85	-0.050	14.13	0.02
40	5.713	0.144	2.12	86	-0.75	100	86	-0.050	15.84	0.04
45	6.433	0.144	2.13	88	-2.59	100	86	-0.060	16.71	0.72
50	7.157	0.145	2.12	89	-0.92	100	85	-0.060	16.85	0.80
55	7.880	0.145	2.12	90	-2.18	100	85	-0.050	15.66	0.06
60	8.603	0.145	2.12	91	-2.74	99	85	-0.060	15.30	0.05
65	9.336	0.147	2.22	92	-1.64	100	86	-0.050	15.82	0.25
70	10.080	0.149	2.23	93	-2.86	102	85	-0.050	16.40	0.88
75	10.821	0.148	2.23	94	-2.9	101	85	-0.050	16.68	0.80
80	11.567	0.149	2.23	94	-2.01	102	86	-0.060	15.44	0.00
85	12.308	0.148	2.23	95	-1.1	101	85	-0.040	15.14	0.00
90	13.054	0.149	2.23	95	-1.08	102	85	-0.060	15.51	0.13
95	13.799	0.149	2.24	96	-1.13	101	85	-0.050	15.80	0.10
100	14.542	0.149	2.22	96	-2.34	101	86	-0.050	15.75	0.05
105	15.290	0.150	2.23	96	-1.24	102	85	-0.040	15.48	0.00
110	16.034	0.149	2.23	97	-2.31	101	84	-0.050	15.73	0.05
115	16.779	0.149	2.22	97	-1.14	101	86	-0.050	16.26	0.83
120	17.527	0.150	2.22	97	-2.94	101	86	-0.050	14.31	0.04
125	18.270	0.149	2.24	98	-2.96	100	84	-0.050	14.15	0.00
130	19.018	0.150	2.21	98	-1.31	101	86	-0.050	13.93	0.00
135	19.764	0.149	2.21	98	-2.15	101	85	-0.050	14.23	0.00
140	20.509	0.149	2.22	98	-2.98	101	85	-0.040	14.03	0.02
145	21.257	0.150	2.23	99	-2.77	101	85	-0.040	13.94	0.00
150	22.003	0.149	2.21	99	-2.93	101	86	-0.050	13.89	0.00
155	22.748	0.149	2.22	99	-1.31	100	85	-0.050	13.67	0.00

BOX B TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
160	23.498	0.150	2.20	99	-2.92	101	84	-0.040	13.84	0.02
165	24.241	0.149	2.23	99	-0.81	100	86	-0.050	13.94	0.02
170	24.989	0.150	2.21	100	-0.91	101	85	-0.050	14.43	0.04
175	25.737	0.150	2.22	100	-2.63	101	84	-0.040	14.62	0.12
180	26.481	0.149	2.22	100	-1.24	100	85	-0.040	14.12	0.21
185	27.229	0.150	2.22	100	-2.68	101	86	-0.050	13.99	0.00
190	27.976	0.149	2.20	100	-0.96	100	85	-0.040	13.41	0.01
195	28.721	0.149	2.21	100	-1.94	100	85	-0.030	12.84	0.00
200	29.469	0.150	2.20	100	-2.95	101	86	-0.050	12.71	0.04
205	30.217	0.150	2.20	100	-2.94	100	85	-0.050	12.60	0.00
210	30.961	0.149	2.22	100	-2.38	100	84	-0.050	12.59	0.00
215	31.711	0.150	2.22	100	-0.94	101	86	-0.040	12.64	0.01
220	32.456	0.149	2.22	100	-1.16	100	85	-0.050	12.70	0.02
225	33.202	0.149	2.22	100	-1.24	100	84	-0.050	12.68	0.01
230	33.952	0.150	2.21	100	-1.56	101	86	-0.050	12.72	0.00
235	34.696	0.149	2.22	100	-2.73	100	85	-0.050	12.58	0.01
240	35.444	0.150	2.20	100	-1.08	100	85	-0.040	12.71	0.00
245	36.191	0.149	2.20	100	-1.21	100	86	-0.040	12.96	0.00
250	36.937	0.149	2.20	100	-1	100	86	-0.050	13.04	0.01
255	37.684	0.149	2.21	100	-1.92	100	85	-0.040	13.54	0.00
260	38.432	0.150	2.22	100	-2.17	100	85	-0.050	13.67	0.03
265	39.176	0.149	2.22	100	-1.31	100	86	-0.030	13.88	0.02
270	39.924	0.150	2.23	100	-2.44	100	85	-0.050	13.94	0.07
275	40.670	0.149	2.21	100	-1.9	100	85	-0.040	14.03	0.02
280	41.416	0.149	2.20	100	-2.94	100	86	-0.050	13.40	0.03
285	42.165	0.150	2.21	100	-2.76	100	85	-0.040	13.46	0.00
290	42.908	0.149	2.21	100	-2.86	100	85	-0.040	13.12	0.03
295	43.656	0.150	2.21	100	-2.5	100	86	-0.050	13.19	0.01
300	44.403	0.149	2.21	100	-1.4	100	85	-0.050	13.26	0.04
305	45.149	0.149	2.22	100	-2.97	100	85	-0.060	13.27	0.07
310	45.895	0.149	2.20	100	-2.91	100	86	-0.050	13.17	0.02
315	46.643	0.150	2.22	100	-2.46	100	85	-0.040	13.74	0.00

BOX B TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
320	47.387	0.149	2.22	100	-2.22	100	85	-0.040	13.78	0.00
325	48.135	0.150	2.22	100	-2.87	100	86	-0.050	14.09	0.02
330	48.880	0.149	2.20	100	-2.98	100	86	-0.030	14.15	0.01
335	49.626	0.149	2.20	100	-2.09	100	85	-0.040	14.23	0.08
340	50.374	0.150	2.21	100	-2.76	100	85	-0.050	14.31	0.18
345	51.118	0.149	2.22	100	-0.97	100	86	-0.040	14.20	0.19
350	51.865	0.149	2.21	100	-2.73	100	85	-0.030	13.39	0.04
355	52.612	0.149	2.21	100	-3	100	85	-0.050	11.75	0.02
360	53.356	0.149	2.20	100	-2.59	100	86	-0.050	11.32	0.00
365	54.103	0.149	2.22	100	-1.45	100	85	-0.040	11.19	0.00
370	54.850	0.149	2.21	100	-2.69	100	85	-0.040	10.98	0.00
375	55.594	0.149	2.21	100	-2.19	100	85	-0.040	10.58	0.01
380	56.343	0.150	2.21	100	-1.96	100	86	-0.040	10.74	0.00
385	57.086	0.149	2.21	100	-1.82	100	84	-0.040	10.69	0.01
390	57.833	0.149	2.21	100	-1.96	100	85	-0.040	10.54	0.00
395	58.580	0.149	2.21	100	-1	100	86	-0.030	10.65	0.01
400	59.324	0.149	2.22	100	-1.55	100	85	-0.040	10.89	0.00
405	60.072	0.150	2.22	100	-1.12	100	85	-0.040	11.12	0.01
410	60.818	0.149	2.22	100	-2.85	100	86	-0.050	11.18	0.02
415	61.562	0.149	2.21	100	-2.84	100	84	-0.030	11.04	0.03
420	62.310	0.150	2.22	100	-2.27	100	85	-0.040	10.93	0.00
425	63.055	0.149	2.22	100	-1.26	100	86	-0.030	10.84	0.01
430	63.800	0.149	2.20	100	-2.74	100	84	-0.030	10.44	0.00
435	64.548	0.150	2.21	100	-2.69	100	85	-0.030	10.26	0.00
440	65.291	0.149	2.22	100	-2.92	99	86	-0.030	9.94	0.02
445	66.038	0.149	2.22	100	-2.99	100	85	-0.030	9.82	0.00
450	66.784	0.149	2.20	100	-1.75	100	85	-0.020	9.76	0.00
455	67.528	0.149	2.22	100	-2.23	100	86	-0.030	9.72	0.00
460	68.275	0.149	2.23	100	-0.94	100	85	-0.030	9.87	0.00
465	69.020	0.149	2.22	100	-0.95	100	85	-0.020	10.14	0.00
470	69.764	0.149	2.21	100	-1.33	100	86	-0.030	10.37	0.00
475	70.512	0.150	2.22	100	-2.92	100	85	-0.020	10.65	0.01

BOX B TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
480	71.254	0.148	2.23	100	-2.74	99	84	-0.030	10.55	0.00
485	72.001	0.149	2.21	100	-1.03	100	85	-0.030	10.71	0.02
490	72.747	0.149	2.21	100	-2.52	100	85	-0.030	10.77	0.01
495	73.490	0.149	2.23	100	-1.26	99	84	-0.030	10.92	0.00
500	74.237	0.149	2.22	100	-1.59	100	85	-0.030	10.88	0.00
505	74.982	0.149	2.23	100	-1.46	100	86	-0.020	10.59	0.01
510	75.725	0.149	2.21	100	-1.01	99	85	-0.030	10.83	0.00
515	76.474	0.150	2.23	100	-0.97	100	85	-0.030	10.61	0.01
520	77.215	0.148	2.23	100	-1.3	99	86	-0.030	10.62	0.01
525	77.963	0.150	2.22	100	-0.86	100	85	-0.020	10.57	0.02
530	78.708	0.149	2.24	100	-1.9	99	84	-0.030	10.54	0.00
535	79.451	0.149	2.22	100	-0.97	99	85	-0.010	10.70	0.00
540	80.198	0.149	2.23	100	-2.69	100	86	-0.020	10.53	0.00
545	80.943	0.149	2.22	100	-0.91	100	84	-0.030	10.64	0.00
550	81.687	0.149	2.23	100	-1.94	99	85	-0.020	10.64	0.01
555	82.434	0.149	2.23	100	-1.84	100	86	-0.020	10.82	0.01
560	83.177	0.149	2.24	100	-2.17	99	85	-0.020	11.02	0.00
565	83.923	0.149	2.23	100	-1.63	100	84	-0.030	11.00	0.02
570	84.669	0.149	2.23	100	-2.53	100	86	-0.020	11.02	0.04
575	85.412	0.149	2.23	100	-2.84	99	85	-0.020	11.48	0.00
580	86.159	0.149	2.22	100	-2.17	100	84	-0.030	11.31	0.00
585	86.902	0.149	2.23	100	-2.52	99	86	-0.020	11.17	0.01
590	87.648	0.149	2.22	100	-1.25	100	85	-0.020	11.06	0.01
595	88.394	0.149	2.23	100	-1.11	100	84	-0.020	11.06	0.00
600	89.138	0.149	2.23	100	-2.99	99	85	-0.030	11.01	0.03
605	89.883	0.149	2.21	100	-2.98	99	86	-0.020	11.02	0.00
610	90.630	0.149	2.25	100	-2.98	100	85	-0.030	10.84	0.02
615	91.372	0.148	2.23	100	-2.53	99	85	-0.020	10.98	0.00
620	92.120	0.150	2.24	100	-1.04	100	86	-0.030	10.75	0.00
625	92.862	0.148	2.23	100	-1.46	99	85	-0.020	10.93	0.00
630	93.609	0.149	2.22	100	-0.92	100	84	-0.020	11.00	0.01
635	94.355	0.149	2.22	100	-2.7	100	86	-0.020	10.83	0.00

BOX B TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
640	95.099	0.149	2.23	100	-1.26	99	85	-0.030	10.84	0.01
645	95.844	0.149	2.23	100	-1.7	99	84	-0.020	10.85	0.00
650	96.591	0.149	2.22	100	-0.99	100	86	-0.020	10.96	0.00
655	97.334	0.149	2.24	100	-2.59	99	85	-0.020	10.85	0.00
660	98.083	0.150	2.22	100	-1.65	100	84	-0.020	11.02	0.00
665	98.825	0.148	2.24	100	-2.92	99	86	-0.030	11.16	0.00
670	99.572	0.149	2.24	100	-1.79	100	85	-0.030	11.05	0.03
675	100.318	0.149	2.24	99	-2.14	100	84	-0.020	11.04	0.01
680	101.062	0.149	2.24	99	-0.96	100	85	-0.020	10.85	0.01
685	101.808	0.149	2.22	99	-3.02	100	86	-0.010	10.67	0.00
690	102.555	0.149	2.25	100	-2.83	100	85	-0.020	10.57	0.00
695	103.297	0.148	2.24	99	-3.06	99	84	-0.020	10.67	0.02
700	104.047	0.150	2.24	99	-1.55	100	86	-0.030	10.66	0.02
705	104.789	0.148	2.23	99	-1.61	99	85	-0.020	10.91	0.00
710	105.536	0.149	2.25	99	-2.69	100	84	-0.020	10.62	0.00
715	106.282	0.149	2.24	99	-3	100	85	-0.020	10.82	0.00
720	107.026	0.149	2.24	99	-1.11	100	85	-0.020	10.67	0.00
725	107.773	0.149	2.23	99	-2.95	100	84	-0.020	10.82	0.00
730	108.519	0.149	2.24	99	-1.76	100	85	-0.030	10.58	0.03
735	109.262	0.149	2.23	99	-2.47	99	86	-0.010	10.59	0.00
740	110.011	0.150	2.24	99	-3.06	100	84	-0.020	10.70	0.00
745	110.755	0.149	2.24	99	-2.4	99	85	-0.020	10.61	0.02
750	111.500	0.149	2.25	99	-2.95	100	86	0.000	10.59	0.02
755	112.248	0.150	2.24	99	-2.73	100	85	-0.020	10.42	0.02
760	112.991	0.149	2.24	99	-2.84	99	84	-0.020	10.54	0.00
765	113.738	0.149	2.24	99	-2.63	100	86	-0.020	10.45	0.01
770	114.485	0.149	2.24	99	-1.16	100	84	-0.020	10.52	0.00
775	115.229	0.149	2.24	99	-3.04	100	85	-0.020	10.52	0.00
780	115.976	0.149	2.25	99	-1.64	100	86	-0.040	10.36	0.02
785	116.722	0.149	2.24	99	-2.27	100	85	-0.020	10.68	0.00
790	117.466	0.149	2.24	99	-2.76	100	84	-0.020	10.39	0.02
795	118.215	0.150	2.24	99	-1.49	100	86	-0.020	10.39	0.00

BOX B TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
800	118.958	0.149	2.24	99	-0.96	99	85	-0.010	10.44	0.02
805	119.705	0.149	2.24	99	-2.11	100	85	-0.020	10.62	0.00
810	120.451	0.149	2.24	99	-1.73	100	86	-0.020	10.47	0.01
815	121.195	0.149	2.25	99	-3.04	100	85	-0.020	10.58	0.00
820	121.943	0.150	2.25	99	-1.1	100	84	-0.020	10.37	0.00
825	122.689	0.149	2.24	99	-0.99	100	85	-0.020	10.40	0.00
830	123.433	0.149	2.25	99	-1.14	99	85	-0.030	10.50	0.00
835	124.182	0.150	2.24	99	-1.08	100	84	-0.020	10.51	0.00
840	124.925	0.149	2.24	99	-1.19	99	85	-0.010	10.35	0.00
845	125.673	0.150	2.26	99	-1.66	100	85	-0.020	10.56	0.00
850	126.419	0.149	2.25	99	-2.86	100	84	-0.030	10.21	0.00
855	127.164	0.149	2.25	99	-3	100	85	-0.020	9.96	0.00
860	127.910	0.149	2.25	99	-0.97	100	85	-0.030	10.04	0.00
865	128.657	0.149	2.25	99	-1.24	100	84	-0.030	9.78	0.03
870	129.401	0.149	2.26	99	-1.23	99	85	-0.020	9.87	0.00
875	130.149	0.150	2.25	99	-0.99	100	85	-0.020	9.91	0.00
880	130.894	0.149	2.25	99	-1.07	100	84	-0.020	9.80	0.00
885	131.639	0.149	2.26	99	-2.11	100	85	-0.020	9.99	0.00
890	132.387	0.150	2.25	99	-1.68	100	86	-0.020	9.91	0.02
895	133.130	0.149	2.24	99	-1.06	99	85	-0.010	9.84	0.00
900	133.878	0.150	2.25	99	-1.38	100	84	-0.020	9.99	0.00
905	134.624	0.149	2.26	99	-3.02	100	86	-0.030	9.90	0.00
910	135.368	0.149	2.25	99	-1.74	99	84	-0.010	9.87	0.00
915	136.116	0.150	2.26	99	-2.99	100	85	-0.020	9.96	0.00
920	136.862	0.149	2.25	99	-2.94	100	86	0.000	9.89	0.00
925	137.606	0.149	2.25	99	-2.71	99	84	-0.010	9.98	0.00
930	138.354	0.150	2.25	99	-0.97	100	85	-0.020	9.93	0.02
935	139.097	0.149	2.25	99	-2.97	99	86	-0.030	9.83	0.02
940	139.845	0.150	2.26	99	-2.02	100	84	-0.010	9.71	0.00
945	140.591	0.149	2.26	99	-2.23	100	85	-0.010	9.70	0.03
950	141.335	0.149	2.24	99	-1.34	99	85	-0.030	9.35	0.02
955	142.081	0.149	2.26	99	-1.47	100	84	-0.020	8.93	0.03

BOX B TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
960	142.829	0.150	2.26	99	-1	100	85	-0.020	8.99	0.00
965	143.571	0.148	2.26	99	-3.07	99	85	-0.020	8.98	0.00
970	144.321	0.150	2.26	99	-2.38	100	84	-0.030	8.87	0.00
975	145.063	0.148	2.25	99	-1.67	99	85	-0.020	8.90	0.00
980	145.810	0.149	2.25	99	-1.73	100	85	-0.010	9.36	0.01
985	146.558	0.150	2.26	99	-2.49	100	84	-0.010	9.52	0.00
990	147.302	0.149	2.26	99	-1.93	99	85	-0.020	9.32	0.00
995	148.049	0.149	2.25	99	-2.74	100	86	-0.010	9.10	0.02
1000	148.795	0.149	2.27	99	-1.44	100	85	-0.010	9.12	0.01
1005	149.539	0.149	2.25	99	-1.83	99	85	-0.020	8.91	0.00
1010	150.287	0.150	2.26	99	-2.98	100	86	0.000	9.01	0.01
1015	151.033	0.149	2.26	99	-1.61	100	84	-0.020	8.97	0.03
1020	151.778	0.149	2.26	99	-3.03	100	84	-0.020	9.13	0.03
1025	152.527	0.150	2.26	99	-0.98	100	85	0.000	9.11	0.01
1030	153.270	0.149	2.26	99	-0.94	99	85	-0.020	8.86	0.00
1035	154.017	0.149	2.24	99	-2.27	100	84	-0.020	6.02	0.12
1040	154.764	0.149	2.27	99	-1.4	100	86	-0.020	10.18	0.00
1045	155.509	0.149	2.24	99	-0.98	100	85	-0.010	10.20	0.02
1050	156.255	0.149	2.27	99	-2.72	100	84	-0.020	10.97	0.02
1055	157.003	0.150	2.27	99	-1.1	100	86	-0.020	10.39	0.00
1060	157.746	0.149	2.25	99	-2.64	99	85	-0.010	9.20	0.01
1065	158.495	0.150	2.26	99	-1.78	100	84	-0.030	8.58	0.00
1070	159.239	0.149	2.26	99	-1.56	100	85	-0.020	8.47	0.00
1075	159.985	0.149	2.27	99	-2.66	100	85	-0.020	8.44	0.00
1080	160.733	0.150	2.27	98	-2.93	100	84	-0.030	8.54	0.00
1085	161.476	0.149	2.26	98	-2.84	99	85	-0.010	8.49	0.00
1090	162.224	0.150	2.26	98	-3.01	100	85	-0.010	8.39	0.00
1095	162.970	0.149	2.26	98	-2.96	100	84	-0.010	8.28	0.02
1100	163.715	0.149	2.27	98	-2.71	100	85	-0.020	8.41	0.01
1105	164.462	0.149	2.25	98	-3.04	100	85	-0.010	8.27	0.00
1110	165.208	0.149	2.28	98	-0.99	100	84	-0.020	8.21	0.00
1115	165.953	0.149	2.28	98	-3.02	100	85	-0.020	7.84	0.02

BOX B TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
1120	166.701	0.150	2.26	98	-1.24	100	85	-0.020	8.03	0.00
1125	167.444	0.149	2.26	98	-2.48	99	84	-0.010	7.65	0.00
1130	168.191	0.149	2.26	98	-0.99	100	85	-0.020	7.34	0.00
1135	168.937	0.149	2.27	98	-3.02	100	85	-0.010	7.55	0.00
1140	169.681	0.149	2.27	98	-0.89	100	84	-0.010	7.33	0.03
Avg/Tot	169.681	0.149	2.22	98	-2.01	100			11.36	0.06

WOODSTOVE SURFACE TEMPERATURE DATA

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
0	457	475	524	455	356	453.4	817
5	439	456	503	448	358	440.8	889
10	410	430	467	524	358	437.8	1131
15	386	409	437	584	355	434.2	1153
20	370	395	415	591	352	424.6	984
25	353	378	398	558	347	406.8	960
30	337	360	379	521	342	387.8	979
35	323	344	364	513	335	375.8	995
40	311	329	350	520	327	367.4	994
45	302	318	339	516	320	359.0	987
50	295	310	330	530	312	355.4	951
55	291	304	324	532	304	351.0	944
60	286	299	317	524	297	344.6	977
65	283	294	312	522	290	340.2	982
70	280	290	308	517	283	335.6	983
75	277	288	306	524	277	334.4	962
80	275	286	306	526	271	332.8	929
85	273	285	305	524	266	330.6	928
90	271	284	304	512	261	326.4	944
95	268	283	304	513	256	324.8	953
100	267	282	305	513	252	323.8	954
105	266	282	306	513	248	323.0	949
110	265	282	307	511	244	321.8	945
115	265	283	308	518	241	323.0	953
120	266	284	310	523	238	324.2	943
125	266	284	313	510	236	321.8	941
130	266	284	315	488	234	317.4	943
135	266	284	316	481	232	315.8	938
140	266	283	317	485	230	316.2	934
145	266	282	318	473	228	313.4	931
150	267	281	317	467	227	311.8	930
155	267	281	318	463	225	310.8	927
160	268	280	318	458	224	309.6	924
165	268	279	318	466	223	310.8	924
170	269	279	319	457	222	309.2	928
175	269	279	319	462	222	310.2	934
180	270	280	320	461	221	310.4	936
185	272	281	321	470	221	313.0	921
190	273	281	322	466	221	312.6	908
195	274	282	322	452	220	310.0	893
200	275	282	322	441	220	308.0	876
205	275	281	323	437	220	307.2	862
210	276	281	323	425	220	305.0	852
215	276	280	323	420	220	303.8	846
220	276	280	322	413	219	302.0	843
225	275	279	321	413	219	301.4	841
230	276	279	320	402	219	299.2	838
235	275	279	319	405	220	299.6	835

WOODSTOVE SURFACE TEMPERATURE DATA

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
240	275	279	318	403	220	299.0	831
245	275	279	317	405	221	299.4	832
250	274	279	316	394	221	296.8	839
255	273	279	316	403	222	298.6	852
260	273	280	316	410	222	300.2	863
265	273	281	316	412	223	301.0	871
270	273	282	317	416	223	302.2	878
275	274	283	319	426	224	305.2	882
280	275	285	320	425	225	306.0	881
285	275	286	322	426	225	306.8	875
290	276	287	324	423	226	307.2	869
295	276	288	326	421	226	307.4	865
300	277	289	328	411	227	306.4	864
305	278	290	330	417	227	308.4	863
310	278	291	332	417	228	309.2	864
315	279	292	333	413	228	309.0	866
320	280	292	335	418	229	310.8	871
325	281	293	337	416	229	311.2	875
330	282	294	339	428	230	314.6	882
335	283	295	341	431	230	316.0	890
340	284	297	344	436	230	318.2	898
345	285	299	347	440	231	320.4	904
350	286	300	351	444	231	322.4	897
355	287	302	355	432	232	321.6	872
360	287	303	359	422	232	320.6	836
365	288	303	362	410	232	319.0	798
370	287	303	363	392	233	315.6	773
375	287	302	363	377	233	312.4	753
380	286	302	362	359	234	308.6	736
385	284	301	360	354	234	306.6	723
390	283	299	358	350	235	305.0	712
395	281	298	356	340	236	302.2	703
400	280	298	354	337	236	301.0	698
405	278	297	352	335	237	299.8	700
410	277	296	351	332	238	298.8	705
415	275	295	350	335	238	298.6	706
420	274	294	349	328	238	296.6	701
425	274	293	348	326	238	295.8	690
430	273	292	348	325	238	295.2	677
435	272	291	347	320	239	293.8	660
440	271	289	345	314	239	291.6	641
445	271	288	344	307	239	289.8	620
450	270	287	342	300	239	287.6	599
455	269	285	341	294	239	285.6	581
460	268	283	339	286	240	283.2	566
465	268	280	338	280	240	281.2	556
470	268	278	338	281	240	281.0	552
475	268	276	340	272	241	279.4	553

WOODSTOVE SURFACE TEMPERATURE DATA

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
480	268	274	342	273	241	279.6	554
485	268	273	345	271	242	279.8	554
490	269	272	347	270	243	280.2	551
495	269	270	351	268	244	280.4	548
500	269	269	355	267	245	281.0	547
505	269	267	359	266	246	281.4	543
510	270	266	363	268	247	282.8	541
515	270	264	365	269	248	283.2	538
520	272	263	367	272	249	284.6	534
525	273	262	368	265	250	283.6	531
530	275	261	367	263	251	283.4	526
535	276	260	367	262	251	283.2	520
540	278	259	366	259	252	282.8	515
545	279	258	365	264	252	283.6	509
550	281	257	364	254	252	281.6	508
555	285	256	362	257	252	282.4	507
560	289	255	362	252	252	282.0	508
565	293	255	361	253	252	282.8	510
570	297	254	361	252	252	283.2	513
575	300	253	361	257	252	284.6	515
580	303	253	360	251	252	283.8	515
585	304	253	360	256	252	285.0	515
590	305	252	360	253	253	284.6	512
595	307	252	359	248	253	283.8	509
600	308	252	359	252	253	284.8	504
605	308	252	358	249	254	284.2	500
610	308	252	358	248	254	284.0	494
615	307	252	358	250	254	284.2	489
620	306	252	358	245	255	283.2	485
625	305	252	359	242	255	282.6	482
630	303	252	361	243	255	282.8	479
635	302	252	362	245	256	283.4	477
640	301	252	363	240	256	282.4	474
645	300	252	364	239	256	282.2	473
650	299	252	365	242	256	282.8	470
655	298	252	365	237	256	281.6	468
660	297	252	365	240	257	282.2	466
665	296	251	366	235	257	281.0	465
670	295	251	366	238	257	281.4	464
675	294	251	367	234	257	280.6	465
680	294	251	368	235	257	281.0	464
685	293	251	369	239	258	282.0	463
690	292	250	368	236	258	280.8	461
695	292	250	368	238	258	281.2	460
700	291	249	368	235	258	280.2	459
705	290	249	368	232	258	279.4	457
710	289	249	368	234	258	279.6	456
715	288	248	368	233	258	279.0	455

WOODSTOVE SURFACE TEMPERATURE DATA

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
720	287	248	369	234	258	279.2	455
725	286	247	369	234	258	278.8	455
730	285	247	371	230	257	278.0	454
735	284	246	371	234	257	278.4	454
740	283	246	370	232	257	277.6	454
745	281	245	367	229	257	275.8	454
750	280	245	364	234	256	275.8	453
755	279	245	362	230	256	274.4	453
760	278	245	361	230	256	274.0	454
765	278	244	359	231	256	273.6	456
770	277	244	358	231	255	273.0	455
775	276	244	355	229	255	271.8	454
780	275	244	354	231	255	271.8	455
785	274	244	353	233	255	271.8	454
790	273	244	352	228	254	270.2	453
795	272	244	350	230	254	270.0	453
800	271	244	350	229	253	269.4	453
805	269	244	348	228	253	268.4	453
810	268	243	348	227	252	267.6	454
815	267	244	347	228	252	267.6	453
820	266	243	346	230	252	267.4	453
825	264	244	345	230	251	266.8	453
830	263	243	344	229	251	266.0	454
835	263	243	343	229	251	265.8	453
840	262	243	343	229	251	265.6	451
845	261	243	342	229	251	265.2	452
850	260	243	342	227	251	264.6	452
855	260	243	342	230	250	265.0	450
860	259	243	341	224	250	263.4	449
865	258	243	341	228	250	264.0	448
870	258	243	339	225	250	263.0	446
875	257	243	337	224	250	262.2	444
880	256	243	336	226	250	262.2	443
885	255	243	335	224	250	261.4	441
890	255	243	334	227	250	261.8	440
895	254	243	334	223	250	260.8	439
900	253	242	334	222	250	260.2	438
905	252	242	333	227	249	260.6	436
910	251	242	333	223	249	259.6	435
915	250	241	332	217	249	257.8	435
920	250	241	332	218	249	258.0	434
925	249	241	332	219	249	258.0	434
930	249	241	332	215	249	257.2	433
935	248	241	331	218	249	257.4	433
940	248	241	330	217	248	256.8	432
945	247	241	328	222	248	257.2	432
950	246	241	327	220	248	256.4	431
955	245	240	324	218	248	255.0	430

WOODSTOVE SURFACE TEMPERATURE DATA

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
960	245	239	320	212	247	252.6	430
965	245	238	316	215	247	252.2	429
970	245	237	312	218	246	251.6	428
975	245	235	309	215	245	249.8	427
980	245	234	305	213	244	248.2	424
985	246	233	303	213	243	247.6	423
990	246	232	300	213	242	246.6	422
995	247	231	297	211	241	245.4	421
1000	247	230	294	206	240	243.4	418
1005	247	229	293	208	239	243.2	416
1010	247	228	290	207	239	242.2	413
1015	247	227	289	208	238	241.8	411
1020	247	226	288	206	237	240.8	410
1025	247	225	287	206	237	240.4	409
1030	247	224	286	204	236	239.4	408
1035	248	223	285	205	235	239.2	411
1040	248	225	285	204	235	239.4	405
1045	247	228	282	205	234	239.2	419
1050	247	231	280	210	234	240.4	446
1055	248	233	278	215	234	241.6	480
1060	248	235	274	223	234	242.8	486
1065	248	235	271	220	235	241.8	470
1070	247	236	267	226	234	242.0	448
1075	246	236	264	221	234	240.2	428
1080	244	236	260	215	233	237.6	415
1085	242	236	256	210	233	235.4	406
1090	240	235	253	209	232	233.8	400
1095	237	234	249	204	232	231.2	395
1100	235	233	246	201	231	229.2	391
1105	232	232	242	202	231	227.8	388
1110	229	231	239	198	230	225.4	383
1115	227	230	236	201	229	224.6	377
1120	224	228	233	192	228	221.0	374
1125	221	226	230	193	227	219.4	368
1130	219	224	227	189	226	217.0	362
1135	217	221	224	186	225	214.6	356
1140	215	219	221	186	224	213.0	351
Average	275	267	334	315	248	288	623

LAB SAMPLE DATA - ASTM E2515

Client: FPI
Model: F3500
Run #: 2

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/11/2018

TRAIN A (1st Hour)

Sample Component	Sample Type	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	T050	89.8	87.6	2.2
B. Rear filter catch	Filter				0.0
C. Probe catch*	Probe				0.0
D. O-Ring catch*	O-Ring				0.0

Sub-Total	Total Particulate, mg:	2.2

TRAIN A (Post 1st hour)

Sample Component	Sample Type	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	T051	175.4	88.0	-0.6
B. Rear filter catch	Filter	T052		88.0	
C. Probe catch*	Probe	6A	116565.1	116565.0	0.1
D. O-Ring catch*	O-Ring	6A	3617.4	3615.3	2.1

Sub-Total	Total Particulate, mg:	1.6
Train A Aggregate	Total Particulate, mg:	**3.8**

TRAIN B

Sample Component	Reagent	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	T053	182.2	89.2	3.4
B. Rear filter catch	Filter	T054		89.6	
C. Probe catch*	Probe	6B	116117.1	116117.1	0.0
D. O-Ring catch*	O-Ring	6B	3396.7	3396.6	0.1

Total Particulate, mg:	**3.5**

AMBIENT

Sample Component	Reagent	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Filter catch*	Filter	T055	89.8	89.8	0.0

Total Particulate, mg:	**0.0**

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

ASTM E3053 Wood Heater Run Sheets

Client: FPI | Job Number: 18-446 | Tracking #: 0016
Model: F3500 | Run Number: 2 | Test Date: 12/11/2018

Wood Heater Run Notes

Pre-Test Notes
Pre-Test Start Time: 10:27
Air Control Setting: High-Fire – Fully Open

Time	Notes
0 min	Loaded 2.4 lbs of kindling and a couple pieces of printer paper, used propane torch for 15 seconds, door left cracked open
3 min	@ 1.4 lbs remaining, added remaining kindling fuel (2.0 lbs), door still cracked
4 min	Door closed
5 min	Closed bypass
8 min	@ 2.5lbs, added 2.0 lbs of start-up fuel
15 min	@ 3.2 lbs, added remaining start-up fuel (4.4 lbs)
29 min	@ 4.6 lbs, stirred fuel to bring unburnt pieces forward for better charcoalization
38 min	@ 3.3 lbs, leveled coal bed, loaded high-fire fuel load, fuel loaded in 35 seconds, door closed in 40 seconds
58 min	Turned fan on high, per manufacturer's instructions
159 min	@ 8.9 lbs, stirred fuel to bring unburnt pieces forward for better charcoalization
170 min	@ 7.1 lbs, stirred fuel to bring unburnt pieces forward for better charcoalization
205 min	@ 4.6 lbs, leveled coal bed, turned off fan, zeroed scale in preparation of fuel loading

Test Notes
Test Burn Start Time: 13:53
Air Control Setting: Fully Closed – Low-Fire Test

Time	Notes
0 min	Loaded low-fire test fuel in 50 seconds, door closed at 90 seconds
15 min	Set air to control to test setting
20 min	Turned fan on low, per manufacturer's instructions
60 min	Changed 1-hour filter
1030 min	Adjusted fuel load to bring coals to the front, 10 minutes had gone by with less than 0.3 lb (1%) weight loss
1140 min	Ended test @ 0.5 lbs, 30 minutes had gone by with less than 0.3 lb (1%) weight loss

Test Burn End Time: 12/12/2018 – 8:53

Flue Gas Concentration Measurement

Calibration Gas Values: Span Gas CO_2 (%): 16.93 CO (%): 4.330
Mid Gas CO_2 (%): 10.00 CO (%): 2.51

Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	11:02	11:13	11:05	10:21	10:23	10:25
CO_2	0.00	10.06	16.93	-0.03	10.21	17.14
CO	0.000	2.497	4.330	-0.007	2.525	4.370

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

Technician Signature:  Date: 12/12/2018

ASTM E3053 Wood Heater Run Sheets

Client: FPI | Job Number: 18-446 | Tracking #: 0016
Model: F3500 | Run Number: 2 | Test Date: 12/11/2018

Test Photos

Kindling Fuel Load

Start-up Fuel Load

High Fire Fuel Load

Residual Start-up Fuel Coal Bed

Technician Signature: _____ Date: 12/12/2018

ASTM E3053 Wood Heater Run Sheets

Client: FPI | Job Number: 18-446 | Tracking #: 0016
Model: F3500 | Run Number: 2 | Test Date: 12/11/2018

High Fire Fuel Loaded

Residual High Fire Load Coal Bed

Low Fire Fuel Load

Low Fire Fuel Loaded

Technician Signature: _____ Date: 12/12/2018

WOOD STOVE TEST DATA PACKET
ASTM E3053/E2515

Run 3 Data Summary

Client:	FPI
Model:	F3500
Job #:	18-446
Tracking #:	0016
Test Date:	12/12/2018

12/18/2018

Techician Signature — Date

TEST RESULTS - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 3

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/12/2018

Burn Rate (kg/hr):	1.39

	Ambient Sample	Sample Train A	Sample Train B	1st Hour Filter
Total Sample Volume (ft^3)	71.691	81.992	83.571	8.681
Average Gas Velocity in Dilution Tunnel (ft/sec)	13.64			
Average Gas Flow Rate in Dilution Tunnel (dscf/hr)	9060.1			
Average Gas Meter Temperature (°F)	75.6	100.7	100.1	80.6
Total Sample Volume (dscf)	71.092	78.296	79.511	10.237
Average Tunnel Temperature (°F)	94.5			
Total Time of Test (min)	565			
Total Particulate Catch (mg)	0.0	6.1	5.9	3.3
Particulate Concentration, dry-standard (g/dscf)	0.0000000	0.0000779	0.0000742	0.0003224
Total PM Emissions (g)	0.00	6.65	6.33	2.92
Particulate Emission Rate (g/hr)	0.00	0.71	0.67	2.92
Emissions Factor (g/kg)	-	0.51	0.48	-
Difference from Average Total Particulate Emissions (g)	-	0.16	0.16	-
Difference from Average Emissions Factor (g/kg)	-	0.01	0.01	-

Final Average Results	
Total Particulate Emissions (g)	6.49
Particulate Emission Rate (g/hr)	0.69
Emissions Factor (g/kg)	0.49
HHV Efficiency (%)	79.4%
LHV Efficiency (%)	84.9%
CO Emissions (g/min)	0.75

Quality Checks	Requirement	Observed	Result
Dual Train Precision	Each train within 7.5% of average emissions (in grams), or emission factors within 0.5 g/kg	See Above	OK
Filter Temps	>80 °F, <90 °F	Min: 83 / Max: 87	OK
Face Velocity	< 30 ft/min	8.2	OK
Leakage Rate	Less than 4% of average sample rate	0 cfm	OK
Ambient Temp	55-90 °F	Min: 73 / Max: 78	OK
Negative Probe Weight Evaluation	<5% of Total Catch	Probe Catch Not Negative	OK
Pro-Rate Variation	90% of readings between 90-110%; none greater than 120% or less than 80%	See Data Tabs	OK

B415.1 Efficiency Results

Manufacturer:	FPI
Model:	F3500
Date:	12/12/18
Run:	3
Control #:	18-446
Test Duration:	565
Output Category:	Medium

Test Results in Accordance with CSA B415.1-09

	HHV Basis	LHV Basis
Overall Efficiency	79.4%	84.9%
Combustion Efficiency	97.8%	97.8%
Heat Transfer Efficiency	81.2%	86.8%

Output Rate (kJ/h)	21,973	20,844	**(Btu/h)**
Burn Rate (kg/h)	1.39	3.06	**(lb/h)**
Input (kJ/h)	27,680	26,258	**(Btu/h)**

Test Load Weight (dry kg)	13.06	28.78	**dry lb**
MC wet (%)	17.53		
MC dry (%)	21.26		
Particulate (g)	6.49		
CO (g)	425		
Test Duration (h)	9.42		

Emissions	**Particulate**	**CO**
g/MJ Output	0.03	2.05
g/kg Dry Fuel	0.50	32.55
g/h	0.69	45.15
g/min	0.01	0.75
lb/MM Btu Output	0.07	4.78

Air/Fuel Ratio (A/F)	10.11

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

HIGH FIRE FUEL LOAD DATA - ASTM E3053

Client: FPI
Job #: 18-446
Model: F3500
Tracking # 0016
Run #: 3
Technician: SJB
Date: 12/12/2018

Nominal Loading Density (lbs/ft^3, wet basis):	10		
Usable Firebox Volume (ft^3):	3.04		
Target Load Weight (lbs):	30.40		
Total Load Weight Range (lbs):	28.90	to	31.90
Core Load Weight Range (lbs):	13.70	to	19.80
Remainder Load Weight Range (lbs):	10.60	to	16.70
Core Load Piece Range (lbs):	4.60	to	7.60
Remainder Load Piece Range (lbs):	3.00	to	16.70
Max Allowable Kindling Weight (lbs):	6.23		
Max Allowable Start-up Fuel Weight (lbs):	9.35		

CORE LOAD DATA

				Fuel Piece Moisture Readings (%DB)					Dry Weight	
Piece #	Length (in)	Weight (lbs)	Within Spec?	1	2	3	Ave.	Within Spec?	lbs	kg
1	17	5.97	In Range	19.8	20.1	21.4	20.4	In Range	4.96	2.25
2	17	5.49	In Range	21.8	22.8	23.2	22.6	In Range	4.48	2.03
3	17	5.49	In Range	19.1	26.5	22.6	22.7	In Range	4.47	2.03
Core Load Wt. (lbs)		16.95	In Range							

REMAINDER LOAD DATA (1 to 3 Pieces)

				Fuel Piece Moisture Readings (%DB)					Dry Weight	
Piece #	Length (in)	Weight (lbs)	Within Spec?	1	2	3	Ave.	Within Spec?	lbs	kg
1	17	3.97	In Range	23.1	19.2	22.7	21.7	In Range	3.26	1.48
2	17	5.14	In Range	18.0	22.7	21.9	20.9	In Range	4.25	1.93
3	17	5.11	In Range	22.4	22.4	19.1	21.3	In Range	4.21	1.91
Remainder Load (lbs)		14.22	In Range							

Total Load Weight (lbs):	31.17	In Range	
Core Load % of Total Weight:	54%	In Range	45-65%
Remainder % of Total Weight:	46%	In Range	35-55%
Total Load % of Target Weight:	103%	In Range	95-105%
Actual Fuel Loading Density (lb/ft3):	10.3		
Total Load Average Moisture Conent (%DB):	21.6	In Range	19-25%
Total Load Average Moisture Conent (%WB):	17.8		
Total Test Load Weight (dry basis):	25.64 lbs	11.63 kg	

KINDLING AND START-UP FUEL

		Kindling Moisture Readings (%DB)					Dry Weight	
Kindling Weight (lbs)	Within Spec?	1	2	3	Avg.	Within Spec?	lbs	kg
4.52	In Range	10	10	10	10.0	In Range	4.11	1.86

		Start-up Moisture Readings (%DB)					Dry Weight	
Start-up Fuel Wt. (lb)	Within Spec?	1	2	3	Avg.	Within Spec?	lbs	kg
6.42	In Range	22.1	20.9	18.4	20.5	In Range	5.33	2.42

TEST FUEL LOADING RANGE

Allowable Residual Start-up Fuel Range (lb):	3.1	to	6.2	
Actual Residual Start-up Fuel Weight (lb):	3.5			In Range

LOW & MEDIUM FIRE FUEL LOAD DATA - ASTM E3053

Client: FPI
Job #: 18-446
Model: F3500
Tracking #: 0016
Run #: 3
Technician: SJB
Date: 12/12/2018

Nominal Loading Density (lbs/ft^3, wet basis):	12		
Usable Firebox Volume (ft^3):	3.04		
Target Load Weight (lbs):	36.48		
Total Load Weight Range (lbs):	34.66	to	38.30
Core Load Weight Range (lbs):	16.42	to	23.71
Remainder Load Weight Range (lbs):	12.77	to	20.06
Core Load Piece Range (lbs):	5.47	to	9.12
Remainder Load Piece Range (lbs):	3.65	to	7.30

CORE LOAD DATA

				Fuel Piece Moisture Readings (%DB)					Dry Weight	
Piece #	Length (in)	Weight (lbs)	Within Spec?	1	2	3	Ave.	Within Spec?	lbs	kg
1	17	5.82	In Range	23.5	22.1	18.4	21.3	In Range	4.80	2.18
2	17	7.32	In Range	21.0	19.2	20.8	20.3	In Range	6.08	2.76
3	17	5.71	In Range	19.7	21.5	23.7	21.6	In Range	4.69	2.13
Core Load Wt. (lbs)		18.85	In Range							

REMAINDER LOAD DATA (3 to 4 Pieces)

				Fuel Piece Moisture Readings (%DB)					Dry Weight	
Piece #	Length (in)	Weight (lbs)	Within Spec?	1	2	3	Ave.	Within Spec?	lbs	kg
1	17	4.59	In Range	19.0	19.6	18.7	19.1	In Range	3.85	1.75
2	17	4.76	In Range	24.2	25.7	24.9	24.9	In Range	3.81	1.73
3	17	6.86	In Range	21.8	21.0	19.8	20.9	In Range	5.68	2.57
4			NA				NA	NA	NA	NA
Remainder Load (lbs)		16.21	In Range							

Remainder Load Small/Large Piece Weight Ratio:	67%	In Range	≤ 67%
Total Load Weight (lbs):	35.06	In Range	
Core Load % of Total Weight:	54%	In Range	45-65%
Remainder % of Total Weight:	46%	In Range	35-55%
Total Load % of Target Weight:	96%	In Range	95-105%
Actual Fuel Loading Density (lb/ft3):	11.5		
Total Load Average Moisture Conent (%DB):	21.3	In Range	19-25%
Total Load Average Moisture Conent (%WB):	17.5		
Total Test Load Weight (dry basis):	28.91 lbs	13.11 kg	

TEST FUEL LOADING RANGE

Allowable Charcoal Bed Weight Range (lb):	3.6	to	7.0	
Actual Charcoal Bed Wt. (lb):		5.8		In Range

TEST END POINT

Actual Fuel Load Ending Weight (lb):	0.0	Valid Test (≥90%)

Total Fuel Burned During Test Run:	35.1	lbs, wet basis
	28.9	lbs, dry basis
	13.12	kg, dry basis

DILUTION TUNNEL & MISC. DATA - ASTM E3053 / E2515

Client:	FPI	Job #:	18-446
Model:	F3500	Tracking #:	0016
Run #:	3	Technician:	SJB
Test Start Time:	14:48	Date:	12/12/2018
Test Type:	Medium Fire		

Recording Interval (min):	5
Total Sampling Time (min):	565

	Pre-Test	Post Test	Avg.
Barometric Pressure (in. Hg)	30.17	30.11	30.14
Relative Humidity (%)	26.2	23.7	
Room Air Velocity (ft/min)	0	0	
Scale Audit (lbs)	10.0	10.0	

Meter Box γ Factor:	1.002	(A)	
Meter Box γ Factor:	0.997	(B)	
Meter Box γ Factor:	0.999	(Ambient)	
Ambient Sample Volume:	71.691	ft^3	

Induced Draft Check (in. H_2O):	0
Smoke Capture Check (%):	100%
Date Flue Pipe Last Cleaned:	12/7/2018

Sample Train Post-Test Leak Checks

(A)	0.000	cfm @	-14	in. Hg
(B)	0.000	cfm @	-17	in. Hg
(Ambient)	0.001	cfm @	-14	in. Hg

DILUTION TUNNEL FLOW

Traverse Data

Point	dP (in H_2O)	Temp (°F)
1	0.032	114
2	0.044	114
3	0.044	114
4	0.032	114
5	0.038	114
6	0.046	114
7	0.048	114
8	0.034	114
Center	0.050	114

Static Pressure: -0.150 in. H_2O

Dilution Tunnel H_2O:	2.00	percent
Tunnel Diameter:	6	inches
Pitot Tube Cp:	0.99	[unitless]
Dilution Tunnel MW(dry):	29.00	lb/lb-mole
Dilution Tunnel MW(wet):	28.78	lb/lb-mole
Tunnel Area:	0.1963	ft^2
V_{strav}:	13.87	ft/sec
V_{scent}:	15.39	ft/sec
F_p:	0.901	[ratio]
Initial Tunnel Flow:	146.4	scf/min

TEST FUEL PROPERTIES

ASTM 3053-17 - Table A1.1 Fuel Properties by Fuel Species

Select Fuel Type	Species	%C	%H	%O	%Ash	MJ/kg	BTU/lb
	Ash, White	49.70	6.90	43.00	0.30	20.75	8927
	Beech	48.70	5.80	44.70	0.60	18.80	8088
	Birch, Sweet	49.80	6.50	43.40	0.30	20.12	8656
	Birch, Yellow	49.80	6.50	43.40	0.30	20.12	8656
	Doug Fir (Coast, Interior West/North)	48.73	6.87	43.90	0.50	19.81	8522
	Doug Fir (Interioir South)	48.73	6.87	43.90	0.50	19.81	8522
	Elm, Rock	50.40	6.60	42.30	0.70	20.49	8815
	Elm, Soft	50.40	6.60	42.30	0.70	20.49	8815
	Gum, Red	50.88	6.06	41.57	1.28	19.72	8478
	Larch, Western	50.54	6.36	42.40	0.70	17.58	7558
X	Maple, Hard	50.64	6.02	41.74	1.35	19.96	8587
	Maple, Sugar	50.64	6.02	41.74	1.35	19.96	8587
	Oak, Red	49.50	6.62	43.70	0.20	20.20	8690
	Oak, White	50.40	6.59	42.70	0.20	20.50	8819
	Pine, Southern	52.60	7.00	40.10	1.31	22.30	9587
	Pine, Southern Long Leaf	52.60	7.02	40.10	1.30	22.30	9594
	Other						

WOODSTOVE PREBURN DATA

Client: FPI
Model: F3500
Run #: 3

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/12/2018

Recording Interval (min): 5
Run Time (min): 235

			Temperatures (°F)							
Elapsed Time (min)	**Scale Reading (lbs)**	**Flue Draft (in H_2O)**	**FB Left**	**FB Right**	**FB Back**	**FB Top**	**FB Bottom**	**Stove Surface Average**	**Flue**	**Ambient**
0	2.2	-0.005	70	71	72	70	73	71.2	71	65
5	3.0	-0.075	104	105	129	125	73	107.2	397	65
10	4.9	-0.090	144	166	180	256	87	166.6	505	66
15	6.9	-0.086	183	210	216	383	110	220.4	588	66
20	5.6	-0.091	223	253	246	477	131	266.0	548	66
25	4.6	-0.085	262	296	277	539	148	304.4	537	66
30	3.7	-0.068	295	342	314	558	163	334.4	529	67
35	33.8	-0.070	324	369	347	549	178	353.4	549	67
40	32.9	-0.089	327	370	351	547	192	357.4	521	67
45	32.2	-0.078	321	365	347	550	203	357.2	510	67
50	31.5	-0.074	313	357	340	542	210	352.4	503	68
55	30.9	-0.082	305	349	334	534	216	347.6	502	68
60	30.2	-0.092	300	343	336	457	219	331.0	489	68
65	29.5	-0.083	297	341	329	446	222	327.0	481	68
70	28.7	-0.073	297	344	324	445	225	327.0	487	69
75	28.0	-0.074	299	352	326	448	227	330.4	496	69
80	27.1	-0.084	303	364	333	442	229	334.2	507	69
85	26.3	-0.080	308	375	344	456	231	342.8	512	69
90	25.5	-0.085	317	384	351	464	233	349.8	514	69
95	24.6	-0.085	329	390	355	478	234	357.2	513	69
100	23.8	-0.089	340	398	362	480	235	363.0	509	69
105	23.1	-0.068	348	407	368	484	236	368.6	501	69
110	22.4	-0.082	355	412	369	470	238	368.8	492	69
115	21.7	-0.089	361	413	369	462	239	368.8	489	69
120	21.1	-0.069	369	414	370	458	241	370.4	484	69
125	20.4	-0.081	377	415	372	461	243	373.6	487	68
130	19.8	-0.064	385	413	374	462	245	375.8	487	68
135	19.1	-0.072	393	412	378	471	248	380.4	490	67
140	18.5	-0.070	399	414	383	475	250	384.2	493	67
145	17.8	-0.069	402	421	390	487	254	390.8	504	67
150	17.0	-0.080	409	427	398	497	259	398.0	514	67
155	16.2	-0.073	417	434	410	509	265	407.0	523	67
160	15.3	-0.085	429	439	424	521	272	417.0	530	67
165	14.5	-0.088	442	444	439	521	279	425.0	530	67
170	13.7	-0.087	454	450	453	530	286	434.6	524	67
175	13.0	-0.080	461	457	461	525	293	439.4	519	67
180	12.3	-0.079	465	470	469	513	301	443.6	576	67
185	11.3	-0.087	467	484	476	515	309	450.2	536	67
190	10.5	-0.064	467	498	487	526	313	458.2	533	67
195	9.8	-0.080	464	509	500	540	314	465.4	528	67
200	9.2	-0.072	461	513	518	540	314	469.2	511	67
205	8.5	-0.092	464	510	535	529	315	470.6	523	67
210	7.6	-0.077	467	497	536	535	316	470.2	521	68
215	7.1	-0.073	475	489	540	541	315	472.0	510	68

WOODSTOVE PREBURN DATA

Client: FPI
Model: F3500
Run #: 3

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/12/2018

Recording Interval (min): 5
Run Time (min): 235

			Temperatures (°F)							
Elapsed Time (min)	**Scale Reading (lbs)**	**Flue Draft (in H_2O)**	**FB Left**	**FB Right**	**FB Back**	**FB Top**	**FB Bottom**	**Stove Surface Average**	**Flue**	**Ambient**
220	6.7	-0.072	482	487	544	533	315	472.2	495	68
225	6.3	-0.071	485	489	553	508	315	470.0	479	68
230	6.0	-0.060	481	491	556	473	316	463.4	510	68
235	5.8	-0.066	479	490	549	464	316	459.6	451	68

BOX A TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 3

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/12/2018

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
0	0.000		0.050	0.01	77	-0.04		34.9		122	494	85	75
5	0.707	0.141	0.050	2.21	78	-0.57	105	33.9	-1	133	533	85	76
10	1.430	0.145	0.050	2.20	79	-3.35	107	32.6	-1.3	132	577	83	76
15	2.148	0.144	0.050	2.15	80	-1.59	106	31.4	-1.2	133	586	84	77
20	2.871	0.145	0.050	2.16	82	-1.32	105	30.5	-0.9	119	463	85	77
25	3.594	0.145	0.050	2.16	83	-2.72	104	29.8	-0.7	111	435	86	78
30	4.318	0.145	0.050	2.17	85	-2.2	104	29.1	-0.7	108	421	84	77
35	5.046	0.146	0.050	2.15	87	-1.39	104	28.6	-0.5	107	415	84	75
40	5.769	0.145	0.050	2.15	89	-1.42	103	27.8	-0.8	106	409	85	76
45	6.500	0.146	0.050	2.12	90	-0.95	104	27.0	-0.8	106	417	86	77
50	7.226	0.145	0.050	2.13	92	-0.99	103	26.3	-0.7	106	421	85	77
55	7.955	0.146	0.050	2.11	93	-1.53	103	25.5	-0.8	105	423	84	77
60	8.681	0.145	0.050	2.12	94	-3.18	102	24.6	-0.9	105	423	84	77
65	9.445	0.153	0.050	2.20	95	-2.3	107	24.0	-0.6	105	415	85	77
70	10.183	0.148	0.050	2.22	96	-2.65	104	23.3	-0.7	105	416	86	76
75	10.925	0.148	0.050	2.18	97	-1.22	104	22.5	-0.8	104	419	83	77
80	11.665	0.148	0.050	2.19	98	-2.67	103	21.9	-0.6	104	419	84	77
85	12.402	0.147	0.050	2.16	99	-1.65	103	21.1	-0.8	105	419	85	78
90	13.142	0.148	0.050	2.16	99	-2.2	103	20.4	-0.7	104	416	86	77
95	13.875	0.147	0.050	2.16	100	0	102	19.8	-0.6	104	414	84	78
100	14.613	0.148	0.050	2.15	100	-0.57	103	19.2	-0.6	103	413	83	78
105	15.344	0.146	0.050	2.14	101	-0.69	101	18.5	-0.7	103	412	84	78
110	16.080	0.147	0.050	2.14	101	-0.09	102	18.0	-0.5	103	410	85	78
115	16.809	0.146	0.050	2.12	101	-0.6	101	17.5	-0.5	103	408	86	77
120	17.544	0.147	0.050	2.11	102	-2.79	102	16.8	-0.7	102	406	84	77
125	18.272	0.146	0.050	2.11	102	-0.97	101	16.2	-0.6	102	401	83	77
130	19.006	0.147	0.050	2.11	102	-2.68	102	15.7	-0.5	102	396	84	77
135	19.734	0.146	0.050	2.08	102	-0.81	101	15.0	-0.7	102	400	85	78
140	20.465	0.146	0.050	2.10	103	-0.03	101	14.5	-0.5	101	398	86	77
145	21.194	0.146	0.050	2.09	103	-0.11	101	14.1	-0.4	101	393	85	78
150	21.922	0.146	0.050	2.10	103	-2.75	100	13.7	-0.4	100	385	83	77
155	22.652	0.146	0.050	2.08	103	-0.73	101	13.2	-0.5	99	375	83	77
160	23.379	0.145	0.050	2.10	103	-0.08	100	12.9	-0.3	99	369	84	77

BOX A TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 3

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/12/2018

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
165	24.110	0.146	0.050	2.10	103	-2.42	101	12.6	-0.3	98	367	85	77
170	24.836	0.145	0.050	2.09	104	-0.98	100	12.2	-0.4	98	367	85	78
175	25.567	0.146	0.050	2.09	103	-1.17	101	11.9	-0.3	98	362	85	77
180	26.291	0.145	0.050	2.10	104	-1.1	99	11.6	-0.3	97	360	85	77
185	27.022	0.146	0.050	2.11	104	-0.1	100	11.3	-0.3	96	357	84	77
190	27.748	0.145	0.050	2.07	104	-2.8	100	11.1	-0.2	96	350	83	77
195	28.477	0.146	0.050	2.08	104	-1.56	100	10.8	-0.3	95	344	83	77
200	29.202	0.145	0.050	2.08	104	-2.14	99	10.6	-0.2	95	339	84	77
205	29.929	0.145	0.050	2.06	104	-0.64	100	10.4	-0.2	94	336	84	77
210	30.659	0.146	0.050	2.07	104	-2.46	100	10.2	-0.2	94	333	85	77
215	31.383	0.145	0.050	2.06	104	-2.69	99	9.9	-0.3	94	330	85	77
220	32.112	0.146	0.050	2.07	104	-0.07	100	9.6	-0.3	94	331	85	77
225	32.836	0.145	0.050	2.08	104	-2.58	99	9.5	-0.1	93	332	85	76
230	33.566	0.146	0.050	2.07	104	-0.28	100	9.2	-0.3	93	335	84	77
235	34.291	0.145	0.050	2.07	104	-0.11	99	9.0	-0.2	93	338	84	77
240	35.015	0.145	0.050	2.08	104	-0.55	99	8.6	-0.4	93	342	83	77
245	35.743	0.146	0.050	2.07	104	-0.07	100	8.5	-0.1	94	344	83	76
250	36.467	0.145	0.050	2.05	104	-2.76	99	8.2	-0.3	94	347	84	76
255	37.195	0.146	0.050	2.06	104	-0.05	100	7.9	-0.3	94	347	84	76
260	37.917	0.144	0.050	2.05	104	-2.28	99	7.6	-0.3	94	345	85	76
265	38.646	0.146	0.050	2.04	104	-2.76	100	7.6	0	94	344	85	76
270	39.369	0.145	0.050	2.06	104	-1.93	99	7.2	-0.4	93	344	86	76
275	40.094	0.145	0.050	2.07	104	-0.86	99	7.0	-0.2	93	342	85	76
280	40.821	0.145	0.050	2.05	104	-1.5	99	6.8	-0.2	93	338	84	76
285	41.543	0.144	0.050	2.05	104	-2.64	99	6.6	-0.2	93	336	84	76
290	42.270	0.145	0.050	2.07	104	-0.91	99	6.4	-0.2	93	335	84	76
295	42.992	0.144	0.050	2.04	104	-2.66	99	6.1	-0.3	93	336	83	76
300	43.715	0.145	0.050	2.05	104	-2.44	99	5.9	-0.2	93	336	83	76
305	44.440	0.145	0.050	2.05	104	-0.18	99	5.7	-0.2	93	339	84	76
310	45.160	0.144	0.050	2.03	104	-0.3	98	5.5	-0.2	92	336	84	76
315	45.885	0.145	0.050	2.05	104	-0.1	99	5.3	-0.2	92	327	85	76
320	46.606	0.144	0.050	2.01	104	-0.25	98	5.2	-0.1	91	313	85	75
325	47.328	0.144	0.050	2.06	104	-2.67	99	5.1	-0.1	90	298	85	75

BOX A TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 3

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/12/2018

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
330	48.054	0.145	0.050	2.06	104	-2.28	99	5.0	-0.1	90	287	85	76
335	48.773	0.144	0.050	2.02	104	-1.89	98	4.8	-0.2	89	279	85	76
340	49.499	0.145	0.050	2.05	104	-0.14	99	4.8	0	88	272	86	75
345	50.220	0.144	0.050	2.04	104	-0.26	98	4.7	-0.1	88	267	85	75
350	50.943	0.145	0.050	2.04	104	-1.65	98	4.6	-0.1	87	262	85	75
355	51.668	0.145	0.050	2.04	104	-2.71	99	4.5	-0.1	87	258	85	75
360	52.387	0.144	0.050	2.05	104	-2.72	98	4.4	-0.1	87	256	85	75
365	53.113	0.145	0.050	2.06	103	-2.48	99	4.3	-0.1	86	255	85	75
370	53.834	0.144	0.050	2.05	103	-2.46	98	4.2	-0.1	86	254	84	75
375	54.556	0.144	0.050	2.04	103	-0.17	98	4.1	-0.1	86	255	84	75
380	55.282	0.145	0.050	2.05	103	-2.5	99	4.0	-0.1	86	256	84	75
385	56.001	0.144	0.050	2.05	103	-1.84	98	3.9	-0.1	86	257	84	74
390	56.728	0.145	0.050	2.04	103	-2.7	99	3.8	-0.1	85	258	83	74
395	57.449	0.144	0.050	2.05	103	-2.39	98	3.7	-0.1	86	259	83	74
400	58.171	0.144	0.050	2.03	103	-1.99	98	3.5	-0.2	86	261	83	74
405	58.897	0.145	0.050	2.04	103	-1.15	99	3.4	-0.1	86	265	83	74
410	59.616	0.144	0.050	2.05	103	-0.27	98	3.3	-0.1	86	267	84	74
415	60.343	0.145	0.050	2.04	103	-0.16	99	3.1	-0.2	86	268	85	74
420	61.063	0.144	0.050	2.05	103	-0.13	98	3.1	0	86	270	85	74
425	61.785	0.144	0.050	2.06	103	-2.8	98	3.0	-0.1	86	272	85	74
430	62.510	0.145	0.050	2.03	103	-0.14	99	2.8	-0.2	86	274	86	74
435	63.229	0.144	0.050	2.05	103	-0.23	98	2.7	-0.1	86	276	86	74
440	63.955	0.145	0.050	2.05	103	-0.27	99	2.6	-0.1	86	277	85	74
445	64.675	0.144	0.050	2.05	103	-2.5	98	2.5	-0.1	86	277	84	74
450	65.397	0.144	0.050	2.03	103	-1.66	98	2.3	-0.2	86	275	84	74
455	66.121	0.145	0.050	2.04	103	-1.5	99	2.2	-0.1	86	274	84	74
460	66.841	0.144	0.050	2.05	102	-0.75	98	2.1	-0.1	86	274	83	74
465	67.565	0.145	0.050	2.05	102	-0.19	99	2.0	-0.1	86	272	83	74
470	68.287	0.144	0.050	2.05	102	-0.17	99	1.8	-0.2	86	273	84	74
475	69.008	0.144	0.050	2.03	102	-2.36	98	1.8	0	86	271	85	74
480	69.732	0.145	0.050	2.07	102	-0.44	99	1.6	-0.2	86	270	85	74
485	70.452	0.144	0.050	2.05	102	-0.24	98	1.5	-0.1	86	269	86	74
490	71.173	0.144	0.050	2.04	102	-2.73	98	1.4	-0.1	86	268	85	74

BOX A TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 3

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/12/2018

	Particulate Sampling Data							Fuel Weight (lb)		Temperature Data (°F)			
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Dilution Tunnel dP (in H_2O)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Scale Reading	Weight Change	Dilution Tunnel	Flue	Filter	Ambient
495	71.898	0.145	0.050	2.03	102	-2.36	99	1.4	0	85	269	85	74
500	72.615	0.143	0.050	2.03	102	-2.07	98	1.3	-0.1	85	268	84	73
505	73.341	0.145	0.050	2.06	102	-0.16	99	1.2	-0.1	85	268	83	74
510	74.060	0.144	0.050	2.02	102	-2.26	98	1.1	-0.1	85	268	83	74
515	74.781	0.144	0.050	2.04	102	-0.2	98	1.0	-0.1	85	266	83	74
520	75.505	0.145	0.050	2.04	102	-0.2	99	0.9	-0.1	85	266	84	73
525	76.223	0.144	0.050	2.04	102	-2.81	98	0.8	-0.1	85	265	84	74
530	76.946	0.145	0.050	2.04	102	-2.68	99	0.7	-0.1	85	265	85	73
535	77.667	0.144	0.050	2.04	102	-2.7	98	0.6	-0.1	85	264	86	73
540	78.387	0.144	0.050	2.04	102	-2.19	98	0.6	0	85	264	86	74
545	79.110	0.145	0.050	2.04	102	-0.31	99	0.4	-0.2	85	266	85	73
550	79.830	0.144	0.050	2.03	102	-2.56	98	0.3	-0.1	85	266	84	74
555	80.550	0.144	0.050	2.04	102	-0.49	98	0.2	-0.1	85	267	84	73
560	81.275	0.145	0.050	2.04	102	-0.13	99	0.1	-0.1	85	268	83	73
565	81.992	0.143	0.050	2.04	102	-0.17	98	0.0	-0.1	85	267	83	73
Avg/Tot	81.992	0.145	0.050	2.06	101	-1.40	100			94	335	84	75.6

BOX B TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 3

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/12/2018

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
0	0.000		0.00	77	-1		85	0.000	8.78	0.02
5	0.685	0.137	2.29	77	-3.41	100	85	-0.080	16.58	0.99
10	1.407	0.144	2.20	78	-1.61	105	86	-0.100	18.17	2.75
15	2.122	0.143	2.15	79	-1.72	104	87	-0.080	18.15	2.34
20	2.832	0.142	2.16	81	-2.66	102	85	-0.070	16.13	0.00
25	3.545	0.143	2.15	83	-1.56	101	86	-0.080	14.60	0.00
30	4.262	0.143	2.14	85	-2.69	101	87	-0.070	14.61	0.00
35	4.979	0.143	2.15	86	-2.01	101	85	-0.070	14.98	0.00
40	5.695	0.143	2.15	88	-1.49	100	85	-0.060	15.18	0.00
45	6.415	0.144	2.14	90	-1.65	100	87	-0.060	16.95	0.81
50	7.132	0.143	2.11	91	-1.77	100	86	-0.070	17.06	1.13
55	7.849	0.143	2.12	92	-2.73	99	85	-0.070	17.20	1.23
60	8.570	0.144	2.13	93	-2.19	100	86	-0.080	17.35	0.83
65	9.304	0.147	2.27	94	-2.7	101	86	-0.070	16.63	0.00
70	10.051	0.149	2.27	95	-3.06	103	85	-0.070	17.01	0.80
75	10.796	0.149	2.27	96	-3.7	102	86	-0.080	17.38	0.69
80	11.540	0.149	2.27	97	-3.35	102	87	-0.070	17.41	0.79
85	12.289	0.150	2.27	98	-2.4	103	85	-0.070	17.39	1.11
90	13.032	0.149	2.27	98	-3.65	102	85	-0.070	17.61	0.85
95	13.781	0.150	2.27	99	-2.1	102	86	-0.080	17.51	0.63
100	14.528	0.149	2.26	99	-2.25	102	86	-0.070	17.42	0.42
105	15.273	0.149	2.25	100	-1.92	102	85	-0.070	17.42	0.56
110	16.022	0.150	2.26	100	-1.63	102	86	-0.070	17.20	0.30
115	16.769	0.149	2.26	101	-2.94	102	87	-0.070	17.04	0.48
120	17.515	0.149	2.26	101	-3.65	101	85	-0.070	15.22	1.32
125	18.263	0.150	2.26	101	-3.53	102	86	-0.070	15.44	1.24
130	19.011	0.150	2.27	101	-1.87	102	87	-0.080	15.37	1.06
135	19.755	0.149	2.24	102	-1.82	101	86	-0.060	16.67	0.94
140	20.504	0.150	2.26	102	-1.76	102	85	-0.050	15.51	0.00
145	21.249	0.149	2.24	102	-3.68	101	86	-0.060	15.14	0.01
150	21.995	0.149	2.25	102	-3.34	101	86	-0.070	14.76	0.00
155	22.745	0.150	2.25	102	-2.73	101	85	-0.070	14.61	0.00

BOX B TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 3

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/12/2018

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
160	23.488	0.149	2.26	103	-1.79	100	86	-0.060	13.43	0.00
165	24.236	0.150	2.24	103	-1.75	101	87	-0.060	12.70	0.00
170	24.983	0.149	2.25	103	-3.25	101	85	-0.070	12.98	0.00
175	25.729	0.149	2.23	103	-2.43	101	85	-0.070	12.80	0.00
180	26.475	0.149	2.23	103	-2.07	101	87	-0.070	12.47	0.00
185	27.223	0.150	2.25	103	-1.75	101	86	-0.060	12.36	0.00
190	27.966	0.149	2.23	103	-2.38	100	85	-0.070	11.63	0.00
195	28.715	0.150	2.23	103	-2.39	101	86	-0.060	11.51	0.00
200	29.458	0.149	2.23	103	-1.77	100	86	-0.050	11.19	0.00
205	30.204	0.149	2.23	103	-2.41	100	85	-0.050	10.89	0.00
210	30.951	0.149	2.23	103	-2.74	100	86	-0.060	10.84	0.00
215	31.694	0.149	2.23	103	-3.46	100	86	-0.060	11.05	0.00
220	32.440	0.149	2.22	103	-3.62	100	85	-0.040	10.98	0.00
225	33.186	0.149	2.23	103	-3.77	100	86	-0.050	11.30	0.00
230	33.928	0.148	2.23	104	-3.33	100	86	-0.060	11.23	0.00
235	34.676	0.150	2.22	104	-3.24	100	85	-0.060	11.38	0.00
240	35.417	0.148	2.23	104	-1.9	99	86	-0.060	11.28	0.00
245	36.162	0.149	2.23	104	-2.39	100	86	-0.060	11.41	0.00
250	36.908	0.149	2.22	104	-2.55	100	85	-0.060	11.41	0.00
255	37.649	0.148	2.22	104	-2.17	99	86	-0.060	11.48	0.00
260	38.394	0.149	2.22	104	-2.08	100	86	-0.060	11.20	0.00
265	39.137	0.149	2.23	104	-3.67	100	85	-0.060	11.10	0.00
270	39.881	0.149	2.22	104	-1.81	100	85	-0.060	11.01	0.00
275	40.624	0.149	2.23	104	-1.94	100	86	-0.060	10.86	0.00
280	41.365	0.148	2.22	104	-1.8	99	85	-0.060	10.75	0.00
285	42.110	0.149	2.22	103	-2.4	100	85	-0.070	10.92	0.00
290	42.851	0.148	2.22	103	-3.7	100	86	-0.060	11.36	0.00
295	43.594	0.149	2.19	103	-2.73	100	86	-0.060	11.59	0.00
300	44.336	0.148	2.22	103	-3.67	100	85	-0.060	11.62	0.00
305	45.075	0.148	2.20	103	-1.86	99	86	-0.060	11.35	0.00
310	45.819	0.149	2.19	103	-1.86	100	86	-0.060	10.96	0.00
315	46.557	0.148	2.21	103	-3.23	99	85	-0.060	10.13	0.00

BOX B TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 3

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/12/2018

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
320	47.299	0.148	2.20	103	-2.07	100	85	-0.060	9.33	0.00
325	48.041	0.148	2.21	103	-2.89	99	86	-0.060	8.91	0.00
330	48.780	0.148	2.21	103	-1.88	99	85	-0.050	8.67	0.00
335	49.523	0.149	2.20	103	-3.27	99	85	-0.060	8.74	0.00
340	50.262	0.148	2.20	103	-2.84	99	86	-0.040	8.49	0.00
345	51.005	0.149	2.21	103	-2.05	99	85	-0.040	8.40	0.00
350	51.744	0.148	2.20	103	-2.01	99	85	-0.050	8.48	0.00
355	52.487	0.149	2.21	103	-3.73	99	86	-0.050	8.76	0.00
360	53.228	0.148	2.21	103	-1.88	99	86	-0.040	8.73	0.00
365	53.967	0.148	2.22	103	-3.88	99	85	-0.040	8.89	0.00
370	54.711	0.149	2.22	103	-3.8	99	86	-0.050	8.98	0.00
375	55.449	0.148	2.20	103	-1.79	99	86	-0.050	8.95	0.00
380	56.191	0.148	2.20	103	-3.21	99	85	-0.050	9.27	0.00
385	56.932	0.148	2.20	103	-2.54	99	85	-0.050	9.41	0.00
390	57.673	0.148	2.20	103	-2.23	99	86	-0.040	9.62	0.00
395	58.415	0.148	2.20	103	-3.83	99	85	-0.050	9.60	0.00
400	59.154	0.148	2.21	103	-3.72	99	85	-0.060	9.76	0.00
405	59.898	0.149	2.20	102	-1.96	99	85	-0.050	9.69	0.00
410	60.636	0.148	2.22	102	-2.65	99	86	-0.050	9.84	0.00
415	61.378	0.148	2.20	102	-2.38	99	85	-0.050	10.00	0.00
420	62.120	0.148	2.21	102	-2.89	99	85	-0.050	10.05	0.00
425	62.858	0.148	2.21	102	-3.83	99	86	-0.050	10.07	0.00
430	63.600	0.148	2.21	102	-2.4	99	86	-0.050	10.27	0.00
435	64.338	0.148	2.21	102	-2.86	99	85	-0.050	10.38	0.00
440	65.080	0.148	2.21	102	-3.7	99	85	-0.050	9.63	0.00
445	65.818	0.148	2.20	102	-3.69	99	86	-0.050	9.60	0.00
450	66.560	0.148	2.20	102	-3.35	99	85	-0.050	9.67	0.00
455	67.301	0.148	2.21	102	-3.79	99	85	-0.040	9.70	0.00
460	68.039	0.148	2.20	102	-3.53	99	86	-0.040	9.62	0.00
465	68.781	0.148	2.20	102	-3.07	99	85	-0.050	9.67	0.00
470	69.519	0.148	2.21	102	-3.78	99	85	-0.040	9.50	0.00
475	70.261	0.148	2.20	102	-1.96	99	86	-0.040	9.48	0.00

BOX B TEST DATA - ASTM E3053 / ASTM E2515

Client: FPI
Model: F3500
Run #: 3

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/12/2018

	Particulate Sampling Data							Flue Gas Data		
Elapsed Time (min)	Gas Meter (ft^3)	Sample Rate (cfm)	Orifice dH (in H_2O)	Meter Temp (°F)	Meter Vacuum (in Hg)	Pro. Rate (%)	Filter (°F)	Flue Draft (in H_2O)	CO_2 (%)	CO (%)
480	70.998	0.147	2.22	102	-1.99	99	86	-0.050	9.65	0.00
485	71.740	0.148	2.20	102	-3.2	99	85	-0.060	9.55	0.00
490	72.481	0.148	2.18	102	-1.98	99	85	-0.050	9.66	0.00
495	73.218	0.147	2.19	102	-1.91	98	86	-0.060	9.68	0.00
500	73.959	0.148	2.20	102	-2.18	99	86	-0.050	9.77	0.00
505	74.698	0.148	2.20	102	-3.38	99	85	-0.040	9.67	0.00
510	75.440	0.148	2.20	102	-3.7	99	85	-0.040	9.50	0.00
515	76.177	0.147	2.21	102	-3.11	98	86	-0.040	9.53	0.00
520	76.918	0.148	2.19	102	-3.05	99	85	-0.050	9.36	0.00
525	77.657	0.148	2.21	102	-2.08	99	85	-0.050	9.48	0.00
530	78.396	0.148	2.19	102	-1.85	99	86	-0.050	9.55	0.00
535	79.137	0.148	2.21	102	-2.06	99	86	-0.050	9.59	0.00
540	79.874	0.147	2.21	102	-3.73	98	84	-0.050	9.54	0.00
545	80.616	0.148	2.20	102	-1.89	99	86	-0.050	9.59	0.00
550	81.353	0.147	2.19	102	-3.82	98	86	-0.040	9.80	0.00
555	82.093	0.148	2.21	102	-1.82	99	85	-0.050	9.68	0.00
560	82.831	0.148	2.20	102	-2.6	99	86	-0.060	9.71	0.00
565	83.571	0.148	2.20	102	-1.81	99	86	-0.050	9.52	0.00
Avg/Tot	83.571	0.148	2.20	100	-2.63	100			11.92	0.19

WOODSTOVE SURFACE TEMPERATURE DATA

Client: FPI
Model: F3500
Run #: 3

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/12/2018

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
0	477	489	547	475	317	461.0	919
5	461	474	522	485	321	452.6	993
10	432	444	487	525	323	442.2	1129
15	409	420	456	572	323	436.0	1160
20	393	404	433	598	322	430.0	1080
25	380	391	421	617	320	425.8	1032
30	367	378	405	591	316	411.4	1008
35	354	367	391	571	311	398.8	994
40	342	359	380	573	306	392.0	993
45	333	352	373	566	301	385.0	1014
50	325	347	367	573	296	381.6	1034
55	320	346	363	567	292	377.6	1036
60	316	347	361	573	288	377.0	1033
65	313	349	360	575	285	376.4	1020
70	311	349	360	586	282	377.6	1056
75	311	347	362	592	280	378.4	1065
80	312	345	365	594	278	378.8	1069
85	314	343	367	595	276	379.0	1067
90	319	343	367	595	275	379.8	1064
95	324	343	365	590	273	379.0	1062
100	329	344	365	590	271	379.8	1058
105	334	346	365	604	270	383.8	1064
110	339	349	366	597	268	383.8	1059
115	343	351	369	601	267	386.2	1045
120	346	352	373	589	265	385.0	1023
125	349	353	380	590	264	387.2	1019
130	352	355	385	572	262	385.2	1003
135	357	356	389	573	259	386.8	1018
140	357	361	392	569	257	387.2	1029
145	353	369	394	563	255	386.8	1017
150	348	376	397	558	252	386.2	978
155	343	382	399	545	249	383.6	955
160	339	385	401	536	247	381.6	950
165	336	385	402	521	244	377.6	955
170	332	385	402	509	241	373.8	953
175	329	389	401	478	238	367.0	952
180	326	394	401	480	236	367.4	944
185	324	400	401	485	234	368.8	936
190	322	407	399	473	233	366.8	914
195	320	414	398	455	232	363.8	887
200	319	414	399	440	231	360.6	871
205	319	414	398	428	230	357.8	858
210	318	415	397	418	230	355.6	851
215	318	416	395	415	230	354.8	850
220	317	417	394	406	230	352.8	858
225	317	417	392	411	230	353.4	867
230	316	419	391	403	230	351.8	882
235	316	419	391	402	230	351.6	898

WOODSTOVE SURFACE TEMPERATURE DATA

Client: FPI
Model: F3500
Run #: 3

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/12/2018

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
240	316	416	391	405	230	351.6	914
245	316	413	394	406	230	351.8	918
250	317	410	397	410	231	353.0	923
255	319	408	401	416	231	355.0	923
260	321	406	405	411	232	355.0	915
265	323	403	408	426	232	358.4	910
270	325	401	412	421	233	358.4	907
275	326	399	418	422	234	359.8	890
280	327	398	425	401	235	357.2	871
285	328	398	432	400	236	358.8	861
290	331	398	438	397	238	360.4	860
295	336	400	441	406	240	364.6	861
300	341	403	439	404	242	365.8	877
305	343	407	436	412	244	368.4	887
310	343	411	433	401	246	366.8	886
315	343	415	433	408	248	369.4	845
320	343	417	431	393	249	366.6	782
325	342	418	429	377	251	363.4	724
330	341	417	426	362	252	359.6	689
335	340	413	422	343	254	354.4	667
340	339	409	419	332	256	351.0	652
345	338	404	415	327	257	348.2	639
350	336	400	412	316	259	344.6	626
355	335	395	410	315	261	343.2	619
360	334	391	409	307	262	340.6	617
365	334	388	410	303	264	339.8	615
370	334	386	411	299	265	339.0	617
375	335	384	412	298	267	339.2	620
380	336	383	416	299	269	340.6	625
385	338	382	421	304	270	343.0	628
390	339	381	427	298	272	343.4	630
395	341	382	433	304	274	346.8	638
400	343	382	440	305	275	349.0	643
405	344	384	446	310	277	352.2	649
410	345	385	455	309	279	354.6	653
415	346	386	462	308	281	356.6	652
420	347	386	468	311	283	359.0	657
425	349	386	473	307	285	360.0	663
430	351	387	479	311	286	362.8	667
435	354	388	486	317	288	366.6	671
440	358	389	492	314	289	368.4	672
445	361	390	492	316	291	370.0	668
450	365	389	488	315	292	369.8	663
455	369	387	486	319	293	370.8	659
460	373	386	484	320	293	371.2	658
465	377	386	481	314	293	370.2	658
470	381	385	479	310	293	369.6	659
475	386	385	477	313	293	370.8	655

WOODSTOVE SURFACE TEMPERATURE DATA

Client: FPI
Model: F3500
Run #: 3

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/12/2018

	Temperature Data (°F)						
Elapsed Time (min)	FB Left	FB Right	FB Back	FB Top	FB Bottom	Stove Surface Average	Catalyst Exit
480	390	385	475	310	292	370.4	649
485	394	384	474	309	292	370.6	644
490	396	383	474	308	292	370.6	641
495	398	383	474	308	292	371.0	639
500	398	382	475	310	292	371.4	636
505	398	381	477	306	292	370.8	637
510	397	381	476	308	292	370.8	637
515	398	379	474	303	292	369.2	631
520	398	377	471	298	292	367.2	625
525	400	375	468	303	293	367.8	621
530	402	373	465	300	293	366.6	619
535	403	371	464	303	294	367.0	619
540	403	369	463	298	294	365.4	622
545	402	367	463	302	295	365.8	627
550	400	365	465	297	295	364.4	630
555	399	363	466	304	295	365.4	633
560	397	362	468	307	296	366.0	634
565	395	362	470	307	296	366.0	633
Average	351	387	425	420	269	370	825

LAB SAMPLE DATA - ASTM E2515

Client: FPI
Model: F3500
Run #: 3

Job #: 18-446
Tracking #: 0016
Technician: SJB
Date: 12/12/2018

TRAIN A (1st Hour)

Sample Component	Sample Type	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	T056	92.9	89.6	3.3
B. Rear filter catch	Filter				0.0
C. Probe catch*	Probe				0.0
D. O-Ring catch*	O-Ring				0.0

Sub-Total	Total Particulate, mg:	3.3

TRAIN A (Post 1st hour)

Sample Component	Sample Type	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	T057	181.8	89.8	2.4
B. Rear filter catch	Filter	T058		89.6	
C. Probe catch*	Probe	7A	116740.2	116739.8	0.4
D. O-Ring catch*	O-Ring	7A	3573.7	3573.8	0.0

Sub-Total	Total Particulate, mg:	2.8
Train A Aggregate	Total Particulate, mg:	**6.1**

TRAIN B

Sample Component	Reagent	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Front filter catch	Filter	T059	185.8	89.8	5.3
B. Rear filter catch	Filter	T060		90.7	
C. Probe catch*	Probe	7B	117305.3	117304.8	0.5
D. O-Ring catch*	O-Ring	7B	3522.1	3522.0	0.1

Total Particulate, mg:	**5.9**

AMBIENT

Sample Component	Reagent	Filter, Probe, or O-Ring #	Weights		
			Final, mg	Tare, mg	Particulate, mg
A. Filter catch*	Filter	T061	90.7	90.7	0.0

Total Particulate, mg:	**0.0**

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

ASTM E3053 Wood Heater Run Sheets

Client: FPI | Job Number: 18-446 | Tracking #: 0016
Model: F3500 | Run Number: 3 | Test Date: 12/12/2018

Wood Heater Run Notes

Pre-Test Notes
Pre-Test Start Time: 10:52
Air Control Setting: High-Fire – Fully Open

Time	Notes
0 min	Loaded 2.2 lbs of kindling and a couple pieces of printer paper, used propane torch for 15 seconds, door left cracked open
2 min	@ 1.4 lbs remaining, added 0.4 lbs of kindling fuel, door still cracked
2.5 min	Closed bypass
3 min	Door closed
4 min	@ 1.4 lbs remaining, added remaining of kindling fuel (1.8 lbs)
8 min	@ 2.4 lbs, added 3.2 lbs of start-up fuel
14 min	@ 4.0 lbs, added remaining start-up fuel (3.2 lbs)
27 min	@ 4.3 lbs, stirred fuel to bring unburnt pieces forward for better charcoalization
31 min	@ 3.5 lbs, leveled coal bed, loaded high-fire fuel load, fuel loaded in 30 seconds, door closed in 35 seconds
51 min	Turned fan on high, per manufacturer's instructions
179 min	@ 12.4 lbs, stirred fuel to bring unburnt pieces forward for better charcoalization
202 min	@ 9.0 lbs, stirred fuel to bring unburnt pieces forward for better charcoalization
229 min	@ 6.1 lbs, stirred fuel to bring unburnt pieces forward for better charcoalization
235 min	@ 5.8 lbs, leveled coal bed, turned off fan, zeroed scale in preparation of fuel loading

Test Notes
Test Burn Start Time: 14:48
Air Control Setting: 1.547" Open from Fully Closed – Medium-Fire Test

Time	Notes
0 min	Loaded medium-fire test fuel in 70 seconds, door closed at 80 seconds
15 min	Set air to control to test setting
20 min	Turned fan on low, per manufacturer's instructions
60 min	Changed 1-hour filter
565 min	Ended of test @ 0.0 lbs

Test Burn End Time: 12/13/18 – 00:13

Flue Gas Concentration Measurement

Calibration Gas Values:
Span Gas CO_2 (%): 16.93 CO (%): 4.330
Mid Gas CO_2 (%): 10.00 CO (%): 2.51

Calibration Results:

	Pre Test			Post Test		
	Zero	Mid	Span	Zero	Mid	Span
Time	10:40	10:45	10:42	8:03	8:01	8:07
CO_2	0.00	10.11	16.93	0.00	9.96	16.77
CO	0.000	2.503	4.330	-0.049	2.419	4.217

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

Technician Signature:  Date: 12/13/2018

ASTM E3053 Wood Heater Run Sheets

Client: FPI | Job Number: 18-446 | Tracking #: 0016
Model: F3500 | Run Number: 3 | Test Date: 12/12/2018

Test Photos

Kindling Fuel Load

Start-up Fuel Load

High Fire Fuel Load

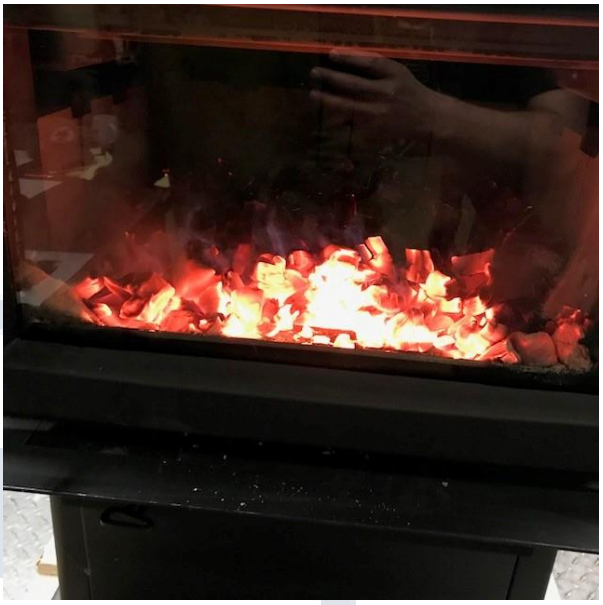
Residual Start-up Fuel Coal Bed

Technician Signature: _____ Date: 12/13/2018

ASTM E3053 Wood Heater Run Sheets

Client: FPI | Job Number: 18-446 | Tracking #: 0016
Model: F3500 | Run Number: 3 | Test Date: 12/12/2018

High Fire Fuel Loaded



Residual High Fire Load Coal Bed

Medium Fire Fuel Load

Medium Fire Fuel Loaded

Technician Signature: _____ Date: 12/13/2018

Sample Pre-Test Tare Sheet: ☐ Probes ☒ TX40 Filters ☐ O-Rings

Date/Time In Desiccator: 6/22/2018 - 12:00 Balance ID#: 107 Audit Weight ID# / Weight(mg): 109A - 100mg

Sample ID	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Tech. Initials	Project/Run #
T031	6/25 - 8:00	84.3	6/26 - 8:30	84.1	–	–	–	–	SB	18-434 #2
T032		84.2		84.2	–	–	–	–	SB	18-434 #3
T033		84.4		84.4	–	–	–	–	SB	
T034		84.2		84.3	–	–	–	–	SB	
T035		85.1		85.1	–	–	–	–	SB	
T036		85.5		85.7	–	–	–	–	SB	
T037		86.1		86.0	–	–	–	–	SB	
T038		85.8		85.8	–	–	–	–	SB	18-438 #1
T039		86.6		86.6	–	–	–	–	SB	
T040		86.6		86.6	–	–	–	–	SB	
T041	12/4 - 8:00	86.4	12/6 - 8:30	86.4	–	–	–	–	SB	
T042		87.2		87.3	–	–	–	–	SB	
T043		87.2		87.4	–	–	–	–	SB	
T044		86.5	12/7 - 8:30	86.6	–	–	–	–	SB	18-446 #1
T045		87.4		87.4	–	–	–	–	SB	
T046		87.9		88.0	–	–	–	–	SB	
T047		87.5		87.5	–	–	–	–	SB	
T048		87.1		87.1	–	–	–	–	SB	
T049		87.4		87.4	–	–	–	–	SB	
T050		87.5		87.6	–	–	–	–	SB	18-446 #2
T051		88.0		88.0	–	–	–	–	SB	
T052		87.9		88.0	–	–	–	–	SB	
T053		89.2		89.2	–	–	–	–	SB	
T054		89.5		89.6	–	–	–	–	SB	
T055		89.7		89.8	–	–	–	–	SB	
T056		89.5		89.6	–	–	–	–	SB	18-446 #3
T057		89.8		89.8	–	–	–	–	SB	
T058		89.7		89.6	–	–	–	–	SB	
T059		89.7		89.8	–	–	–	–	SB	
T060		90.7		90.7	–	–	–	–	SB	

Sample Post-Test Analysis Sheet: ☐ Probes ☒ TX40 Filters ☐ O-Rings

Balance ID#: 107 Audit Weight ID# / Weight (mg): _____

Sample ID	Tare (mg)	Date/ Time in Desiccator	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Tech. Initials
T031	84.1	10/30 - 19:10	~~51~~ THIS FILTER WAS WEIGHED AS A PAIR WITH T028 + T029								SB
T032	84.2	10/31 - 16:30	11/2 - 8:00	85.9	11/2 - 15:30	85.9	–	–	–	–	SB
T033	84.4	↓	↓	> 169.8	↓	> 169.8	–	–	–	–	SB
T034	84.3						–	–	–	–	SB
T035	85.1			> 173.9		> 173.8	–	–	–	–	SB
T036	85.7						–	–	–	–	SB
T037	86.0	↓	↓	85.9	↓	86.0	–	–	–	–	SB
T038	85.8	12/6 - 18:00	12/10 - 10:00	85.9	12/11 - 8:00	86.0	–	–	–	–	SB
T039	86.6	↓	↓	> 174.7	↓	> 174.7	–	–	–	–	SB
T040	86.6						–	–	–	–	SB
T041	86.4			> 175.3		> 175.2	–	–	–	–	SB
T042	87.3						–	–	–	–	SB
T043	87.4	↓	↓	87.5	↓	87.4	–	–	–	–	SB
T044	86.6	12/16 - 14:20	12/12 - 9:00	91.1	12/13 - 8:15	91.1	–	–	–	–	SB
T045	87.4	↓	↓	> 178.8	↓	> 178.8	–	–	–	–	SB
T046	88.0					~~182.5~~ SB	–	–	–	–	SB
T047	87.5			> 182.6		> 182.5	–	–	–	–	SB
T048	87.1						–	–	–	–	SB
T049	87.4	↓	↓	87.5	↓	87.4	–	–	–	–	SB
T050	87.6	12/12 - 9:15	12/14 - 9:45	89.7	12/17 - 8:00	89.8	–	–	–	–	SB
T051	88.0	↓	↓	> 175.4	↓	> 175.4	–	–	–	–	SB
T052	88.0						–	–	–	–	SB
T053	89.2			> 182.1		> 182.2	–	–	–	–	SB
T054	89.6						–	–	–	–	SB
T055	89.8	↓		89.9		89.8	–	–	–	–	SB
T056	89.6	12/13 - 8:30		92.7		92.9	–	–	–	–	SB
T057	91.8	↓		> 181.7		> 181.8	–	–	–	–	SB
T058	89.6						–	–	–	–	SB
T059	91.8			> 185.7		> 185.8	–	–	–	–	SB
T060	90.7	↓	↓		↓		–	–	–	–	SB

Sample Pre-Test Tare Sheet: ☐ Probes ☒ TX40 Filters ☐ O-Rings

Date/Time In Desiccator: 12/7 - 11:00 Balance ID#: 107 Audit Weight ID# / Weight(mg): 109A-100mg

Sample ID	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Tech. Initials	Project/Run #
T061	12/11-13:00	90.8	12/12 - 9:00	90.7	–	–	~	~	SB	18-446
T062										
T063										
T064										
T065										
T066										
T067										
T068										
T069										
T070										
T071										
T072										
T073										
T074										
T075										
T076										
T077										
T078										
T079										
T080										
T081										
T082										
T083										
T084										
T085										
T086										
T087										
T088										
T089										
T090										

Sample Post-Test Analysis Sheet: ☐ Probes ☒ TX40 Filters ☐ O-Rings

Balance ID#: 107 Audit Weight ID# / Weight (mg): 109A-100mg

Sample ID	Tare (mg)	Date/ Time in Desiccator	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Tech. Initials
T061	90.7	12/13-8:30	12/14-9:45	90.6	12/17-8:40	90.7	-	-	-	-	SB
T062											
T063											
T064											
T065											
T066											
T067											
T068											
T069											
T070											
T071											
T072											
T073											
T074											
T075											
T076											
T077											
T078											
T079											
T080											
T081											
T082											
T083											
T084											
T085											
T086											
T087											
T088											
T089											
T090											

Sample Pre-Test Tare Sheet: ☒ Probes ☐ Filters ☐ O-Rings

Date/Time In Desiccator: 10/22/2018 - 8:00 Balance ID#: 107 Audit Weight ID# / Weight(mg): 109A/B – 100/200mg

Sample ID	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Tech. Initials	Project/Run #
1A	10/25-8:00	115028.5	10/26-8:00	115628.6	-	-	-	-	JB	18-434 #1
1B	↓	115902.7	↓	115902.8	-	-	-	-	JB	18-434 #1
2A		116240.2		116240.2	-	-	-	-	JB	18-434 #2
2B		116330.3		116330.3	-	-	-	-	JB	18-434 #2
3A		116073.5		116073.6	-	-	-	-	JB	18-434 #3
3B	↓	116340.3	↓	116340.3	-	-	-	-	JB	18-434 #3
4A	12/4-8:00	116183.4	12/6-8:00	116183.2	-	-	-	-	JB	18-438 #1
4B	↓	116366.0	12/6-8:00	116365.9	-	-	-	-	JB	18-438 #1
5A		116768.6	12/7-8:30	116768.6	-	-	-	-	JB	18-446 #1
5B		116880.5	↓	116880.6	-	-	-	-	JB	18-446 #1
6A		116564.9		116565.0	-	-	-	-	JB	18-446 #2
6B		116117.0		116117.1	-	-	-	-	JB	18-446 #2
7A		116739.7		116739.8	-	-	-	-	JB	18-446 #3
7B	↓	117304.7	↓	117304.8	-	-	-	-	JB	18-446 #3
8A										
8B										
9A										
9B										
10A										
10B										
11A										
11B										
12A										
12B										
13A										
13B										
14A										
14B										

Sample Post-Test Analysis Sheet: ☒ Probes ☐ Filters ☐ O-Rings

Balance ID#: 107 Audit Weight ID# / Weight (mg): 109A/B / 100/200mg

Sample ID	Tare (mg)	Date/ Time in Desiccator	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Tech. Initials
1A	115628.6	10/29 - 13:50	10/30 - 18:00	115628.7	10/31 - 6:00	115628.8	-	-	-	-	SB
1B	115902.8	10/29 - 17:50	10/30 - 18:00	115903.0	10/31 - 6:00	115903.0	-	-	-	-	SB
2A	116240.2	10/30 - 19:10	11/1 - 8:00	116240.5	11/2 - 7:30	116240.5	-	-	-	-	SB
2B	116330.3	10/30 - 19:10	11/1 - 8:00	116330.7	11/2 - 7:30	116330.7	-	-	-	-	SB
3A	116073.6	10/31 - 16:30	11/2 - 7:30	116073.9	11/2 - 15:30	116073.9	-	-	-	-	SB
3B	116340.3	10/31 - 16:30	11/2 - 7:30	116340.7	11/2 - 15:30	116340.6	-	-	-	-	SB
4A	116183.2	12/6 - 18:00	12/10 - 10:00	116183.4	12/11 - 8:00	116183.4	-	-	-	-	SB
4B	116365.9	12/6 - 18:00	12/10 - 10:00	116366.0	12/11 - 8:00	116366.1	-	-	-	-	SB
5A	116768.6	12/10 - 14:20	12/12 - 9:00	116769.4	12/13 - 8:15	116769.3	-	-	-	-	SB
5B	116880.6	12/10 - 14:20	12/12 - 9:00	116881.3	12/13 - 8:15	116881.2	-	-	-	-	SB
6A	116565.0	12/12 - 9:15	12/14 - 9:45	116565.3	12/17 - 8:00	116565.0	12/18 - 8:00	116565.1	-	-	SB
6B	116117.1	12/12 - 9:15	12/14 - 9:45	116117.5	12/17 - 8:00	116117.1	12/18 - 8:00	116117.1	-	-	SB
7A	116739.8	12/13 - 8:30	12/14 - 9:45	116740.5	12/17 - 8:00	116740.2	12/18 - 8:00	116740.2	-	-	SB
7B	117304.8	12/13 - 8:30	12/14 - 9:45	117305.4	12/17 - 8:00	117305.3	-	-	-	-	SB
8A											
8B											
9A											
9B											
10A											
10B											
11A											
11B											
12A											
12B											
13A											
13B											
14A											
14B											

Sample Pre-Test Tare Sheet: ☐ Probes ☐ Filters ☒ O-Rings

Date/Time In Desiccator: 10/22/2018 - 8:00 Balance ID#: 107 Audit Weight ID# / Weight(mg): 109B-200mg

Sample ID	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Date/Time	Weight (mg)	Tech. Initials	Project/Run #
1A	10/25 - 8:00	3566.2	10/26 - 8:50	3566.1	–	–	–	–	SB	18-434 #1
1B		3554.5		3554.4	–	–	–	–	SB	18-434 #1
2A		3552.4		3552.6	–	–	–	–	SB	18-434 #2
2B		3570.8		3570.8	–	–	–	–	SB	18-434 #2
3A		3579.6		3579.7	–	–	–	–	SB	18-434 #3
3B		3567.8		3567.8	–	–	–	–	SB	18-434 #3
4A	12/4 - 8:00	3593.8	12/6 - 8:00	3593.8	–	–	–	–	SB	18-438 #1
4B		3581.6	12/6 - 8:00	3581.5	–	–	–	–	SB	18-438 #1
5A		3534.3	12/7 - 8:30	3534.1	–	–	–	–	SB	18-446 #1
5B		3530.6		3530.5	–	–	–	–	SB	18-446 #1
6A		3615.2		3615.3	–	–	–	–	SB	18-446 #2
6B		3396.6		3396.6	–	–	–	–	SB	18-446 #2
7A		3573.8		3573.8	–	–	–	–	SB	18-446 #3
7B		3522.0		3522.0	–	–	–	–	SB	18-446 #3
8A										
8B										
9A										
9B										
10A										
10B										
11A										
11B										
12A										
12B										
13A										
13B										
14A										
14B										

Sample Post-Test Analysis Sheet: ☐ Probes ☐ Filters ☒ O-Rings

Balance ID#: 107 Audit Weight ID# / Weight (mg): 109 B- 200 mg

Sample ID	Tare (mg)	Date/ Time in Desiccator	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Date/ Time	Weight (mg)	Tech. Initials
1A	3566.1	10/29-17:50	10/30 - 18:00	3566.4	10/31 - 6:00	3566.5	-	-	-	-	SB
1B	3554.4	10/29-17:50	10/30 - 18:00	3556.6	10/31 - 6:00	3556.7	-	-	-	-	SB
2A	3552.6	10/30 - 19:10	11/1 - 8:00	3552.8	11/2 - 7:30	3552.9	-	-	-	-	SB
2B	3570.8	10/30 - 19:10	11/1 - 8:00	3570.9	11/2 - 7:30	3571.0	-	-	-	-	SB
3A	3579.7	10/31 - 16:30	11/2 - 7:30	3579.9	11/2 - 15:30	3580.0	-	-	-	-	SB
3B	3567.8	10/31 - 16:30	11/2 - 7:30	3568.4	11/2 - 15:30	3568.3	-	-	-	-	SB
4A	3593.8	12/6 - 18:00	12/10 - 10:00	3594.1	12/11 - 8:00	3594.1	-	-	-	-	SB
4B	3581.5	12/6 - 18:00	12/10 - 10:00	3582.0	12/11 - 8:00	3582.0	-	-	-	-	SB
5A	3534.1	12/10 - 14:20	12/12 - 9:10	3534.2	12/13 - 8:15	3534.1	-	-	-	-	SB
5B	3530.5	12/10 - 14:20	12/12 - 9:10	3530.7	12/13 - 8:15	3530.7	-	-	-	-	SB
6A	3615.3	12/12 - 9:15	12/14 - 9:45	3617.3	12/17 - 8:00	3617.4	-	-	-	-	SB
6B	3396.6	12/12 - 9:15	12/14 - 9:45	3396.7	12/17 - 8:00	3396.7	-	-	-	-	SB
7A	3573.8	12/13 - 8:30	12/14 - 9:45	3573.6	12/17 - 8:00	3573.7	-	-	-	-	SB
7B	3522.0	12/13 - 8:30	12/14 - 9:45	3522.2	12/17 - 8:00	3522.1	-	-	-	-	SB
8A											
8B											
9A											
9B											
10A											
10B											
11A											
11B											
12A											
12B											
13A											
13B											
14A											
14B											

Sample Calculations – ASTM E3053 & E2515

Client: FPI
Model: F3500
Run: 2

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_{Fldb} – Weight of test fuel load, dry basis, lb (kg)

M_{SUdb} – Weight of start-up fuel, dry basis, lb (kg)

M_{Kdb} - Weight of kindling, dry basis, lb (kg)

M_{FREHdb} - Total weight of all remaining fuel at end of high fire test run, lb (kg)

M_{TFBHdb} - Total weight of all fuel burned during high fire test run, lb (kg), dry basis

BR_H – Dry burn rate for high fire test run, from time when test fuel load is added to end of test run, lb/h (kg/h)

M_{TFBdb} - Total weight of fuel burned during low or medium fire test run, lb (kg), dry basis

BR - Dry burn rate for low and medium fire test runs, lb/h (kg/h)

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

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

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

m_n – Total particulate matter collected, mg

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

E_T – Total particulate emissions, g

PR - Proportional rate variation

PM_{RH} - Particulate emission rate for high fire test run, g/hr

PM_{FH} - Particulate emission factor for high fire test run, g/dry kg of fuel burned

PM_R – Particulate emission rate for low or medium fire test run, g/hr

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

M_{Fldb} – Weight of test fuel load, dry basis, lb (kg)
ASTM E3053 equation (1)

$$M_{Fldb} = \Sigma((M_{FLnwb})(100/(100 + MC_{FLn})))$$

Where,

M_{FLnwb} = Weight of each test fuel piece, n, in test fuel load per 8.4.1, wet basis, lb (kg)
MC_{FLn} = Average fuel moisture of test fuel piece, n, in test fuel load, % dry basis
n = individual test fuel pieces that comprise the test fuel load, as applicable.

Sample Calculation:

n	M_{FLnwb}	MC_{FLn}	$(M_{FLnwb})(100/(100 + MC_{FLn}))$		
1	5.97	23.7	5.97 (100) / (100+ 23.7)) =	4.82	
2	7.14	24.6	7.14 (100) / (100+ 24.6)) =	5.73	
3	5.95	21.5	5.95 (100) / (100+ 21.5)) =	4.90	
4	4.01	19.3	4.01 (100) / (100+ 19.3)) =	3.36	
5	5.40	23.6	5.4 (100) / (100+ 23.6)) =	4.37	
6	6.83	24.9	6.83 (100) / (100+ 24.9)) =	5.47	
7	0.00	NA	N/A	-	
			SUM	28.65	lbs

M_{Fldb} = **28.65** lbs
M_{Fldb} = **12.99** kg

M_{SUdb} – Weight of start-up fuel, dry basis, lb (kg)
ASTM E3053 equation (2)

$$M_{SUdb} = (M_{SUwb})(100/(100 + MC_{SU}))$$

Where,

M_{SUwb} = Total weight of start-up fuel pieces, wet basis, lb (kg)

MC_{SU} = Average fuel moisture of the piece(s) from which start-up fuel was split, % dry basis

Sample Calculation:

M_{SUwb} = N/A - Applicable to High Fire Tests Only

MC_{SU} = N/A - Applicable to High Fire Tests Only

M_{SUdb} = N/A (100/(100+ N/A)

M_{SUdb} = **N/A** lbs

= **N/A** kg

M_{Kdb} - Weight of kindling, dry basis, lb (kg)
ASTM E3053 equation (3)

$$M_{Kdb} = (M_{Kwb})(100/(100 + MC_K))$$

Where,

M_{Kwb} = Weight of kindling per 8.5.6, wet basis, lb (kg);

MC_K = Average moisture of kindling (may be assumed 10%), % dry basis.

Sample calculation:

M_{Kwb} = N/A - Applicable to High Fire Tests Only

MC_K = N/A - Applicable to High Fire Tests Only

M_{Kdb} = N/A (100/(100+ N/A)

M_{Kdb} = **N/A** lbs

= **N/A** kgs

M_{FREHdb} - Total weight of all remaining fuel at end of high fire test run, lb (kg)
ASTM E3053 equation (4)

$$M_{FREHdb} = M_{RSUBdb} + M_{FLEHdb}$$

Where,

M_{RSUBdb} = Weight of residual start-up fuel bed when high fire test load added, lb (kg)

M_{FLEHdb} = Weight of unburned portion of test fuel load at the end of the high fire test run, lb (kg)

Sample calculation:

M_{RSUBdb} = N/A - Applicable to High Fire Tests Only

M_{FLEHdb} = N/A - Applicable to High Fire Tests Only

M_{FREHdb} = N/A + N/A

M_{FREHdb} = **N/A** lbs

= **N/A** kg

M_{TFBHdb} - Total weight of all fuel burned during high fire test run, lb (kg), dry basis

ASTM E3053 equation (5)

$$M_{TFBHdb} = M_{Kdb} + M_{SUdb} + M_{FLdb} - M_{FREHdb}$$

Sample Calculation:

M_{Kdb} = N/A

M_{SUdb} = N/A

M_{FLdb} = N/A

M_{FREHdb} = N/A

M_{TFBHdb} = N/A + N/A + N/A - N/A

= **N/A** lbs

= **N/A** kg

BR_H – Dry burn rate for high fire test run, from time when test fuel load is added to end of test run, lb/h (kg/h)

ASTM E3053 equation (6)

$$BR_H = 60 (M_{FLdb} - M_{FLEHdb})/\theta_{H1}$$

Where,

θ_{H1} = Total duration of high fire test run, from time when test fuel load is added to end of test run, min.

Sample calculation:

M_{FLdb} = N/A - Applicable to High Fire Tests Only

M_{FLEHdb} = N/A - Applicable to High Fire Tests Only

θ_{H1} = N/A - Applicable to High Fire Tests Only

$$BR_H = \frac{60 (\text{N/A} - \text{N/A})}{\text{N/A}}$$

BR_H = **N/A** lb/hr

= **N/A** kg/hr

M_{TFBdb} - Total weight of fuel burned during low or medium fire test run, lb (kg), dry basis
ASTM E3053 equation (7)

$$M_{TFBdb} = M_{FLdb} - M_{FREdb}$$

Where,

M_{FLdb} = Total weight of fuel burned during low or medium fire test run, lb (kg), dry basis

M_{FREdb} = Weight of remaining fuel at end of low or medium fire test run, lb (kg)

Sample Calculation:

M_{FLdb} = 28.65

M_{FREdb} = 0.50

M_{TFBdb} = 28.65 - 0.50

= **28.15** lbs

= **12.77** kg

BR - Dry burn rate for low and medium fire test runs, lb/h (kg/h)
ASTM E3053 equation (8)

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

Where,

θ = Total test run duration for low or medium fire test run, min.

Sample Calculation:

M_{TFBdb} = 28.15
θ = 1140.00

$$BR = \frac{60 \times 28.15}{1140}$$

BR = **1.48** lb/hr
= **0.67** kg/hr

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

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

Where:

F_p = Adjustment factor for pitot tube center point reading = $\frac{V_{strav}}{V_{scent}}$, ASTM E2515 Equation (1)

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

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

k_p = Pitot tube constant, 85.49

C_p = Pitot tube coefficient: 0.99, unitless

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

$$Fp = \frac{14.15}{15.57} = 0.908$$

$$V_s = 0.908 \times 85.49 \times 0.99 \times 0.224 \times \left(\frac{79.6 + 460}{\left(29.98 + \frac{-0.16}{13.6}\right) \times 28.78} \right)^{1/2}$$

V_s = **13.60** 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:

$$Q_{sd} = 3600 \times (1 - 0.02) \times 13.60 \times 0.1963 \times \frac{528}{79.6 + 460} \times \frac{29.98 + \frac{-0.16}{13.6}}{29.92}$$

Q_{sd} = **9232.8** dscf/hr

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

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

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:

$$V_{m(std)} = 17.64 \times \#\#\#\#\#\# \times 1.002 \times \frac{\left(29.98 + \frac{2.23}{13.6}\right)}{(98.8 + 460)}$$

$V_{m(std)}$ = **163.782** dscf

Using equation for Train 2:

$$V_{m(std)} = 17.64 \times \#\#\#\#\#\# \times 0.997 \times \frac{\left(29.98 + \frac{2.22}{13.6}\right)}{(98.2 + 460)}$$

$V_{m(std)}$ = **161.135** dscf

Using equation for ambient train:

$$V_{m(std)} = 17.64 \times 145.56 \times 0.999 \times \frac{\left(29.98 + \frac{0.00}{13.6}\right)}{(71.1 + 460)}$$

$V_{m(std)}$ = **144.809** dscf

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

$$m_n = m_p + m_f + m_g$$

Where:

m_p = mass of particulate matter from probe, mg

m_f = mass of particulate matter from filters, mg

m_g = mass of particulate matter from filter seals, mg

Sample Calculation:

Using equation for Train A (first hour):

m_n = 0.0 + 2.2 + 0.0

m_n = 2.2 mg

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

m_n = 0.1 + -0.6 + 2.1

m_n = 1.6 mg

Train A aggregate:

m_n = 2.2 + 1.6

m_n = **3.8** mg

Using equation for Train B:

m_n = 0 + 3.4 + 0.1

m_n = **3.5** mg

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

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

Where:

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:

$$C_s = 0.001 \times \frac{3.8}{163.78}$$

C_s = **0.00002** g/dscf

For Train 2

$$C_s = 0.001 \times \frac{3.5}{161.14}$$

C_s = **0.00002** g/dscf

For Ambient Train

$$C_r = 0.001 \times \frac{0.0}{144.81}$$

C_r = **0.000000** 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 = (0.000023 - 0.000000) x 9232.8 x 1140 /60

E_T = **4.07** g

For Train 2

E_T = (0.000022 - 0.000000) x 9232.8 x 1140 /60

E_T = **3.81** g

Average

E = **3.94** g

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

7.5% of the average =	0.30
Train 1 difference =	0.13
Train 2 difference =	0.13

PR - Proportional Rate Variation

ASTM E2515 equation (16)

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

Where:

θ = Total sampling time, min

θ_i = Length of recording interval, min

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

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

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

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

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

T_m = Absolute average dry gas meter temperature, ^oR

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

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

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

$$PR = \left(\frac{\#\#\# \times 0.731 \times 13.60 \times (121.0 + 460) \times (98.8 + 460)}{5 \times 171.77 \times 14.11 \times (79.6 + 460) \times (76.0 + 460)} \right) \times 100$$

PR = **105** %

PM_{RH} - Particulate emission rate for high fire test run, g/hr;
ASTM E3053 equation (9)

$$PM_{RH} = 60(E_{TH}/\theta_{H2})$$

Where,

E_{TH} = Total particulate emissions for high fire test run including kindling and start-up, g

θ_{H2} = Total duration of high fire test run, from ignition of kindling to end of test run, min.

Sample Calculation:

E_{TH} = N/A - Applicable to High Fire Tests Only

θ_{H2} = N/A - Applicable to High Fire Tests Only

PM_{RH} = 60(N/A / N/A)

PM_{RH} = **N/A** g/hr

PM_{FH} - Particulate emission factor for high fire test run, g/dry kg of fuel burned.

ASTM E3053 equation (10)

$$PM_{FH} = E_{TH}/M_{TFBHdb}$$

Sample Calculation:

E_{TH} = N/A - Applicable to High Fire Tests Only

M_{TFBHdb} = N/A - Applicable to High Fire Tests Only

PM_{FH} = N/A / N/A

= **N/A** g/kg

PM_R - Particulate emission rate for low or medium fire test runs, g/hr
ASTM E3053 equation (12)

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

Where,

E_T = Total particulate emissions for low or medium fire test runs from Test Method E2515, g

Sample Calculation:

E_T = 3.94
θ = 1140

PM_R = 60(3.94 / 1140)

PM_{RH} = **0.21** g/hr

PM_{FH} - Particulate emission factor for high fire test run, g/dry kg of fuel burned.
ASTM E3053 equation (13)

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

Sample Calculation:

E_T = 3.94
M_{TFBdb} = 12.77

PM_{FH} = 3.94 / 12.77
= **0.31** g/kg

Sample Calculations – ASTM E3053 & E2515

Client: FPI
Model: F3500
Run: 2

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_{Fldb} – Weight of test fuel load, dry basis, lb (kg)

M_{SUdb} – Weight of start-up fuel, dry basis, lb (kg)

M_{Kdb} - Weight of kindling, dry basis, lb (kg)

M_{FREHdb} - Total weight of all remaining fuel at end of high fire test run, lb (kg)

M_{TFBHdb} - Total weight of all fuel burned during high fire test run, lb (kg), dry basis

BR_H – Dry burn rate for high fire test run, from time when test fuel load is added to end of test run, lb/h (kg/h)

M_{TFBdb} - Total weight of fuel burned during low or medium fire test run, lb (kg), dry basis

BR - Dry burn rate for low and medium fire test runs, lb/h (kg/h)

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

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

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

m_n – Total particulate matter collected, mg

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

E_T – Total particulate emissions, g

PR - Proportional rate variation

PM_{RH} - Particulate emission rate for high fire test run, g/hr

PM_{FH} - Particulate emission factor for high fire test run, g/dry kg of fuel burned

PM_R – Particulate emission rate for low or medium fire test run, g/hr

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

M_{Fldb} – Weight of test fuel load, dry basis, lb (kg)
ASTM E3053 equation (1)

$$M_{Fldb} = \Sigma((M_{FLnwb})(100/(100 + MC_{FLn})))$$

Where,

M_{FLnwb} = Weight of each test fuel piece, n, in test fuel load per 8.4.1, wet basis, lb (kg)
MC_{FLn} = Average fuel moisture of test fuel piece, n, in test fuel load, % dry basis
n = individual test fuel pieces that comprise the test fuel load, as applicable.

Sample Calculation:

n	M_{FLnwb}	MC_{FLn}	$(M_{FLnwb})(100/(100 + MC_{FLn}))$		
1	5.97	23.7	5.97 (100) / (100+ 23.7)) =	4.82	
2	7.14	24.6	7.14 (100) / (100+ 24.6)) =	5.73	
3	5.95	21.5	5.95 (100) / (100+ 21.5)) =	4.90	
4	4.01	19.3	4.01 (100) / (100+ 19.3)) =	3.36	
5	5.40	23.6	5.4 (100) / (100+ 23.6)) =	4.37	
6	6.83	24.9	6.83 (100) / (100+ 24.9)) =	5.47	
7	0.00	NA	N/A	-	
			SUM	28.65	lbs

M_{Fldb} = **28.65** lbs
M_{Fldb} = **12.99** kg

M_{SUdb} – Weight of start-up fuel, dry basis, lb (kg)
ASTM E3053 equation (2)

$$M_{SUdb} = (M_{SUwb})(100/(100 + MC_{SU}))$$

Where,

M_{SUwb} = Total weight of start-up fuel pieces, wet basis, lb (kg)

MC_{SU} = Average fuel moisture of the piece(s) from which start-up fuel was split, % dry basis

Sample Calculation:

M_{SUwb} = N/A - Applicable to High Fire Tests Only

MC_{SU} = N/A - Applicable to High Fire Tests Only

M_{SUdb} = N/A (100/(100+ N/A)

M_{SUdb} = **N/A** lbs

= **N/A** kg

M_{Kdb} - Weight of kindling, dry basis, lb (kg)
ASTM E3053 equation (3)

$$M_{Kdb} = (M_{Kwb})(100/(100 + MC_K))$$

Where,

M_{Kwb} = Weight of kindling per 8.5.6, wet basis, lb (kg);

MC_K = Average moisture of kindling (may be assumed 10%), % dry basis.

Sample calculation:

M_{Kwb} = N/A - Applicable to High Fire Tests Only

MC_K = N/A - Applicable to High Fire Tests Only

M_{Kdb} = N/A (100/(100+ N/A)

M_{Kdb} = **N/A** lbs

= **N/A** kgs

M_{FREHdb} - Total weight of all remaining fuel at end of high fire test run, lb (kg)
ASTM E3053 equation (4)

$$M_{FREHdb} = M_{RSUBdb} + M_{FLEHdb}$$

Where,

M_{RSUBdb} = Weight of residual start-up fuel bed when high fire test load added, lb (kg)

M_{FLEHdb} = Weight of unburned portion of test fuel load at the end of the high fire test run, lb (kg)

Sample calculation:

M_{RSUBdb} = N/A - Applicable to High Fire Tests Only

M_{FLEHdb} = N/A - Applicable to High Fire Tests Only

M_{FREHdb} = N/A + N/A

M_{FREHdb} = **N/A** lbs

= **N/A** kg

M_{TFBHdb} - Total weight of all fuel burned during high fire test run, lb (kg), dry basis

ASTM E3053 equation (5)

$$M_{TFBHdb} = M_{Kdb} + M_{SUdb} + M_{FLdb} - M_{FREHdb}$$

Sample Calculation:

M_{Kdb} = N/A

M_{SUdb} = N/A

M_{FLdb} = N/A

M_{FREHdb} = N/A

M_{TFBHdb} = N/A + N/A + N/A - N/A

= **N/A** lbs

= **N/A** kg

BR_H – Dry burn rate for high fire test run, from time when test fuel load is added to end of test run, lb/h (kg/h)

ASTM E3053 equation (6)

$$BR_H = 60 (M_{FLdb} - M_{FLEHdb})/\theta_{H1}$$

Where,

θ_{H1} = Total duration of high fire test run, from time when test fuel load is added to end of test run, min.

Sample calculation:

M_{FLdb} = N/A - Applicable to High Fire Tests Only

M_{FLEHdb} = N/A - Applicable to High Fire Tests Only

θ_{H1} = N/A - Applicable to High Fire Tests Only

$$BR_H = \frac{60 (\text{N/A} - \text{N/A})}{\text{N/A}}$$

BR_H = **N/A** lb/hr

= **N/A** kg/hr

M_{TFBdb} - Total weight of fuel burned during low or medium fire test run, lb (kg), dry basis
ASTM E3053 equation (7)

$$M_{TFBdb} = M_{FLdb} - M_{FREdb}$$

Where,

M_{FLdb} = Total weight of fuel burned during low or medium fire test run, lb (kg), dry basis

M_{FREdb} = Weight of remaining fuel at end of low or medium fire test run, lb (kg)

Sample Calculation:

M_{FLdb} = 28.65

M_{FREdb} = 0.50

M_{TFBdb} = 28.65 - 0.50

= **28.15** lbs

= **12.77** kg

BR - Dry burn rate for low and medium fire test runs, lb/h (kg/h)
ASTM E3053 equation (8)

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

Where,

θ = Total test run duration for low or medium fire test run, min.

Sample Calculation:

M_{TFBdb} = 28.15
θ = 1140.00

$$BR = \frac{60 \times 28.15}{1140}$$

BR = **1.48** lb/hr
= **0.67** kg/hr

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

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

Where:

F_p = Adjustment factor for pitot tube center point reading = $\frac{V_{strav}}{V_{scent}}$, ASTM E2515 Equation (1)

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

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

k_p = Pitot tube constant, 85.49

C_p = Pitot tube coefficient: 0.99, unitless

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

$$Fp = \frac{14.15}{15.57} = 0.908$$

$$V_s = 0.908 \times 85.49 \times 0.99 \times 0.224 \times \left(\frac{79.6 + 460}{\left(29.98 + \frac{-0.16}{13.6}\right) \times 28.78} \right)^{1/2}$$

V_s = **13.60** 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:

$$Q_{sd} = 3600 \times (1 - 0.02) \times 13.60 \times 0.1963 \times \frac{528}{79.6 + 460} \times \frac{29.98 + \frac{-0.16}{13.6}}{29.92}$$

Q_{sd} = **9232.8** dscf/hr

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

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

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:

$$V_{m(std)} = 17.64 \times \#\#\#\#\#\# \times 1.002 \times \frac{\left(29.98 + \frac{2.23}{13.6}\right)}{(98.8 + 460)}$$

$V_{m(std)}$ = **163.782** dscf

Using equation for Train 2:

$$V_{m(std)} = 17.64 \times \#\#\#\#\#\# \times 0.997 \times \frac{\left(29.98 + \frac{2.22}{13.6}\right)}{(98.2 + 460)}$$

$V_{m(std)}$ = **161.135** dscf

Using equation for ambient train:

$$V_{m(std)} = 17.64 \times 145.56 \times 0.999 \times \frac{\left(29.98 + \frac{0.00}{13.6}\right)}{(71.1 + 460)}$$

$V_{m(std)}$ = **144.809** dscf

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

$$m_n = m_p + m_f + m_g$$

Where:

m_p = mass of particulate matter from probe, mg

m_f = mass of particulate matter from filters, mg

m_g = mass of particulate matter from filter seals, mg

Sample Calculation:

Using equation for Train A (first hour):

m_n = 0.0 + 1.9 + 0.0

m_n = 1.9 mg

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

m_n = 0.0 + 2.0 + 0.7

m_n = 2.7 mg

Train A aggregate:

m_n = 1.9 + 2.7

m_n = **4.6** mg

Using equation for Train B:

m_n = 0.4 + 4.2 + 0.4

m_n = **5** mg

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

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

Where:

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:

$$C_s = 0.001 \times \frac{4.6}{163.78}$$

C_s = **0.00003** g/dscf

For Train 2

$$C_s = 0.001 \times \frac{5.0}{161.14}$$

C_s = **0.00003** g/dscf

For Ambient Train

$$C_r = 0.001 \times \frac{0.0}{144.81}$$

C_r = **0.000000** 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 = (0.000028 - 0.000000) x 9232.8 x 1140 /60

E_T = **4.93** g

For Train 2

E_T = (0.000031 - 0.000000) x 9232.8 x 1140 /60

E_T = **5.44** g

Average

E = **5.19** g

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

7.5% of the average =	0.39
Train 1 difference =	0.26
Train 2 difference =	0.26

PR - Proportional Rate Variation

ASTM E2515 equation (16)

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

Where:

θ = Total sampling time, min

θ_i = Length of recording interval, min

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

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

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

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

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

T_m = Absolute average dry gas meter temperature, ^oR

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

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

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

$$PR = \left(\frac{\#\#\# \times 0.731 \times 13.60 \times (121.0 + 460) \times (98.8 + 460)}{5 \times 171.77 \times 14.11 \times (79.6 + 460) \times (76.0 + 460)} \right) \times 100$$

PR = **105** %

PM_{RH} - Particulate emission rate for high fire test run, g/hr;
ASTM E3053 equation (9)

$$PM_{RH} = 60(E_{TH}/\theta_{H2})$$

Where,

E_{TH} = Total particulate emissions for high fire test run including kindling and start-up, g

θ_{H2} = Total duration of high fire test run, from ignition of kindling to end of test run, min.

Sample Calculation:

E_{TH} = N/A - Applicable to High Fire Tests Only

θ_{H2} = N/A - Applicable to High Fire Tests Only

PM_{RH} = 60(N/A / N/A)

PM_{RH} = **N/A** g/hr

PM_{FH} - Particulate emission factor for high fire test run, g/dry kg of fuel burned.

ASTM E3053 equation (10)

$$PM_{FH} = E_{TH}/M_{TFBHdb}$$

Sample Calculation:

E_{TH} = N/A - Applicable to High Fire Tests Only

M_{TFBHdb} = N/A - Applicable to High Fire Tests Only

PM_{FH} = N/A / N/A

= **N/A** g/kg

PM_R - Particulate emission rate for low or medium fire test runs, g/hr
ASTM E3053 equation (12)

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

Where,

E_T = Total particulate emissions for low or medium fire test runs from Test Method E2515, g

Sample Calculation:

E_T = 5.19
θ = 1140

PM_R = 60(5.19 / 1140)

PM_{RH} = **0.27** g/hr

PM_{FH} - Particulate emission factor for high fire test run, g/dry kg of fuel burned.

ASTM E3053 equation (13)

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

Sample Calculation:

E_T = 5.19
M_{TFBdb} = 12.77

PM_{FH} = 5.19 / 12.77
= **0.41** g/kg

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

FEB 2 8 2018

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

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

Dear Mr. White,

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Sincerely,

Steffan M. Johnson, Group Leader
Measurement Technology Group

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

431

LISTED ROOM HEATER, SOLID FUEL TYPE, ALSO FOR USE IN MOBILE HOME INSTALLATION

DO NOT REMOVE THIS LABEL

431

MODEL: REGENCY FREESTANDING STOVE - F3500

0219WS024S

TESTED TO: UL-1482 -2011 / ULC-S627-00

U.S. ENVIRONMENTAL PROTECTION AGENCY CERTIFIED TO COMPLY WITH 2020 PARTICULATE EMISSION STANDARDS USING CORD WOOD." TESTED TO ASTM E3053. MODEL REGENCY F3500 – 0.9G /HR. THIS WOOD HEATER NEEDS PERIODIC INSPECTION AND REPAIR FOR PROPER OPERATION. CONSULT THE OWNER'S MANUAL FOR FURTHER INFORMATION. IT IS AGAINST FEDERAL REGULATIONS TO OPERATE THIS WOOD HEATER IN A MANNER INCONSISTENT WITH THE OPERATING INSTRUCTIONS IN THE OWNER'S MANUAL.

CERTIFIÉ CONFORME AUX NORMES 2020 DU U.S. ENVIRONMENTAL PROTECTION AGENCY EN MATIÈRE D'ÉMISSION DE PARTICULES DE BOIS AVEC DU BOIS DE CORDE". APPROUVÉ ASTM E3053. MODÈLE REGENCY F3500 – 0,9 G /H. CET APPAREIL DE CHAUFFAGE AU BOIS DOIT ÊTRE INSPECTÉ PÉRIODIQUEMENT ET RÉPARÉ POUR FONCTIONNER CORRECTEMENT. CONSULTER LE MANUEL D'INSTALLATION POUR PLUS D'INFORMATION. LA RÉGLEMENTATION FÉDÉRALE INTERDIT DE FAIRE FONCTIONNER UN TEL APPAREIL SI LES CONSIGNES D'UTILISATION CONTENUES DANS LE PRÉSENT MANUEL NE SONT PAS RESPECTÉES.

INSTALL AND USE ONLY IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION AND OPERATING INSTRUCTIONS. CONTACT LOCAL BUILDING OR FIRE OFFICIALS ABOUT RESTRICTIONS AND INSTALLATION INSPECTION IN YOUR AREA. USE 6"(152MM) DIAMETER MINIMUM 24 MSG BLACK OR 26 MSG BLUED STEEL CONNECTOR WITH LISTED UL103 HT or ULCS629 FACTORY-BUILT CHIMNEY SUITABLE FOR USE WITH SOLID FUELS OR MASONRY CHIMNEY.
SEE LOCAL BUILDING CODE AND MANUFACTURER'S INSTRUCTIONS FOR PRECAUTIONS REQUIRED FOR PASSING A CHIMNEY THROUGH A COMBUSTIBLE WALL OR CEILING. DO NOT PASS CHIMNEY CONNECTOR THROUGH COMBUSTIBLE WALL OR CEILING. DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE.
CAUTION: BURNING OF MATERIAL OTHER THAN THE SPECIFIED FUELS MAY MAKE THE CATALYST IN THE COMBUSTOR INACTIVE. THE COMBUSTOR IS FRAGILE, HANDLE CAREFULLY.
THE PERFORMANCE OF THE CATALYTIC DEVICE OR ITS' DURABILITY HAS NOT BEEN EVALUATED AS PART OF THE CERTIFICATION.
INSTALLER ET UTILISER SEULEMENT SELON LES INSTRUCTIONS D'INSTALLATION ET D'UTILISATION DU FABRICANT.
CONTACTER LES RESPONSABLES DU BÂTIMENT OU DU SERVICE-INCENDIE DE VOTRE RÉGION POUR CONNAÎTRE LES RESTRICTIONS ET EXIGENCES D'INSPECTION DANS VOTRE RÉGION. UTILISER UN CONNECTEUR D'UN DIAMÈTRE MINIMAL DE 152 MM (6 PO) 24 MSG EN ACIER NOIR OU 26 MSG EN ACIER BRONZÉ AVEC CHEMINÉE PRÉFABRIQUÉE HOMOLOGUÉE
CONÇUE POUR UTILISATION AVEC COMBUSTIBLES SOLIDES OU UNE CHEMINÉE DE MAÇONNERIE.
VOIR LE CODE DU BÂTIMENT LOCAL ET LES INSTRUCTIONS DU FABRICANT CONCERNANT LES PRÉCAUTIONS EXIGÉES POUR INSTALLER UNE CHEMINÉE TRAVERSANT UN MUR OU PLAFOND EN MATÉRIAUX COMBUSTIBLES. NE FAITES PAS TRAVERSER LE CONNECTEUR DE CHEMINÉE DANS UN MUR OU PLAFOND EN MATÉRIAUX COMBUSTIBLES. NE RACCORDEZ PAS CE POÊLE À BOIS À UN CONDUIT DE CHEMINÉE DESSERVANT UN AUTRE APPAREIL.
CERTIFICATION DU MAISON MOBILE, APPAREIL DE CHAUFFAGE AMBIANT HOMOLOGUÉ À COMBUSTIBLE SOLIDE, CONVENANT AUSSI POUR INSTALLATION DANS UNE MAISON MOBILE.

MINIMUM CLEARANCES TO COMBUSTIBLE MATERIALS	
INSTALLATION USING 6" SINGLE WALL OR LISTED DOUBLE WALL CONNECTOR ONLY: RESIDENTIAL, ALCOVE, MOBILE HOME	
To Top of stove: A) 279mm / 11"	To Flue Centre Line: E) 406mm / 16"
To Rear Shield: B) 241mm / 9.5"	To Flue Centre Line: F) 521mm / 20-1/2"
To Corner of Stove: C) 203mm / 8"	Alcove width: G) 1524mm / 60"
To Flue Centre Line: D) 610mm / 24"	To Top of Flue: H) 152mm / 6"

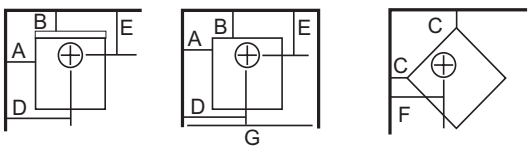
FLOOR PROTECTION*

In USA:
V 203 mm / 8"
W 406 mm / 16"
X 1067 mm / 42"
Y 1181 mm / 46-1/2"
Z 203 mm / 8"
In Canada:
V 203 mm / 8"
W 450 mm / 18"
X 1067 mm / 42"
Y 1232 mm / 48-1/2"
Z 203 mm / 8"

REGENCY FIREPLACE PRODUCTS

MANUFACTURED BY:

FPI FIREPLACE PRODUCTS INTERNATIONAL LTD.
6988 VENTURE ST.
DELTA, BC V4G 1H4
MADE IN CANADA



MINIMUM PARALLEL / ALCOVE CEILING HEIGHT: 2.1 M / 83" MAXIMUM ALCOVE DEPTH 1219 MM / 48 IN.
HAUTEUR MINIMALE DU PLAFOND DE L'ALCÔVE : 2,1 M / 83PO. PROFONDEUR MAXIMALE DE L'ALCÔVE : 1219 MM / 48 PO.

WARNING: THE SPACE BENEATH THE HEATER MUST NOT BE OBSTRUCTED. OPERATE ONLY WITH FIREBRICKS IN PLACE.
FOR USE WITH SOLID WOOD FUEL ONLY. USE OF OTHER FUELS MAY DAMAGE HEATER AND CREATE A HAZARDOUS CONDITION. DO NOT OBSTRUCT COMBUSTION AIR OPENINGS. OPERATE ONLY WITH FIREBRICKS IN PLACE. RISK OF SMOKE AND FLAME SPILLAGE, OPERATE ONLY WITH DOORS FULLY CLOSED. DO NOT USE GRATE OR ELEVATE FIRE. BUILD WOOD FIRE DIRECTLY ON HEARTH. DO NOT OVERFIRE - IF HEATER OR CHIMNEY CONNECTOR GLOWS YOU ARE OVERFIRING. INSPECT AND CLEAN CHIMNEY AND CONNECTOR FREQUENTLY. UNDER CERTAIN CONDITIONS OF USE CREOSOTE BUILDUP MAY OCCUR RAPIDLY. KEEP FURNISHINGS AND OTHER COMBUSTIBLE MATERIAL AWAY FROM HEATER. REPLACE GLASS ONLY WITH NEOCERAM GLASS. COMBUSTIBLE FLOOR MUST BE PROTECTED BY NON-COMBUSTIBLE MATERIAL EXTENDING BENEATH THE HEATER AND TO THE FRONT AND SIDES AS INDICATED OR TO THE NEAREST PERMITTED COMBUSTIBLE MATERIAL.
OPTIONAL COMPONENTS: FAN (846-515), ELECTRICAL RATING: VOLTS 115, 60 HZ, 2 AMPS., AIRMATE, OUTSIDE AIR KIT, ASH DRAWER, COMBUSTOR PART #051-530
THIS WOOD HEATER CONTAIN A CATALYTIC COMBUSTOR WHICH REQUIRES PERIODIC INSPECTION AND REPLACEMENT FOR PROPER OPERATION. IT IS AGAINST THE LAW TO OPERATE THIS WOOD HEATER IN A MANNER INCONSISTENT WITH OPERATING INSTRUCTIONS IN INSTRUCTION MANUAL, OR IF THE CATALYTIC ELEMENT IS DEACTIVATED OR REMOVED.
DANGER: RISK OF ELECTRIC SHOCK. DISCONNECT POWER BEFORE SERVICING UNIT. DO NOT ROUTE POWER CORD UNDER OR IN FRONT OF APPLIANCE.
CAUTION: MOVING PARTS MAY CAUSE INJURY. DO NOT OPERATE UNIT WITH FAN HOSING REMOVED.
CAUTION: HOT PARTS. DO NOT OPERATE UNIT WITH DOOR OR GLASS REMOVED.
COMPONENTS REQUIRED FOR MOBILE HOME INSTALLATION: OUTSIDE AIR KIT AND ONE OF THE FOLLOWING DOUBLE WALL CONNECTOR
IN CANADA: LISTED SECURITY MODEL DP, OR OLIVER MACLEOD PRO-VENT PV DOUBLE WALLED CONNECTOR WITH LISTED CHIMNEY SYSTEM: LISTED SECURITY MODEL SECURITY S2100+, ICC EXCEL 2100, SIMPSON DURA-PLUS HTC, SELKIRK SENTINAL CF.
IN USA: LISTED DOUBLE WALL CONNECTORS SECURITY MODEL DP, SELKIRK MODEL DS, OLIVER MACLEOD PRO VENT PV, SIMPSON DURA VENT MODEL DVL, METAL-FAB DOUBLE WALL. CONNECTED TO ONE OF THE FOLLOWING COMPATIBLE CHIMNEY SYSTEMS SELKIRK SURE-TEMP, PROJET Nova Temp, SECURITY SECURE TEMP ASH+, SECURITY SECURE TEMP S-2100+, METAL-FAB TEMP/GUARD 2100, AMERI-TEC HS, ICC EXCEL 2100 . USE CHIMNEY COMPONENTS AS SPECIFIED IN INSTALLATION INSTRUCTIONS.

AVERTISSEMENT : L'ESPACE SITUÉ SOUS L'APPAREIL DE CHAUFFAGE NE DOIT PAS ÊTRE OBSTRUÉ. FAIRE FONCTIONNER SEULEMENT LORSQUE LES BRIQUES SONT EN PLACE.
À UTILISER SEULEMENT AVEC UN COMBUSTIBLE DE BOIS SOLIDE. L'UTILISATION D'AUTRES COMBUSTIBLES PEUT ENDOMMAGER L'APPAREIL DE CHAUFFAGE ET PRÉSENTER UN DANGER. NE PAS OBSTRUER LES OUVERTURES DE L'AIR DE COMBUSTION. FAIRE FONCTIONNER SEULEMENT LORSQUE LES BRIQUES SONT EN PLACE. RISQUE DE FUMÉE ET DE DÉBORDEMENT DES FLAMMES. FAIRE FONCTIONNER SEULEMENT AVEC LES PORTES COMPLÈTEMENT FERMÉES. NE PAS UTILISER DE GRILLE NI SURÉLEVER LE FOYER. FAIRE LE FEU DIRECTEMENT SUR L'ÂTRE. NE PAS SURCHAUFFER - SI LE POÊLE OU LE CONNECTEUR DE CHEMINÉE ROUGEOIE, IL Y A SURCHAUFFE. INSPECTER ET FAIRE RAMONER FRÉQUEMMENT LA CHEMINÉE ET LE CONNECTEUR. DANS CERTAINES CONDITIONS D'UTILISATION, UN DÉPÔT DE CRÉOSOTE PEUT SE FORMER RAPIDEMENT. TENIR LES MEUBLES ET TOUT AUTRE MATÉRIAU COMBUSTIBLE À DISTANCE DU FEU. REMPLACER LA VITRE SEULEMENT PAR UNE VITRE NÉOCÉRAM. LE PLANCHER COMBUSTIBLE DOIT ÊTRE PROTÉGÉ PAR UN MATÉRIAU NON COMBUSTIBLE SE PROLONGEANT SOUS L'APPAREIL, À L'AVANT ET SUR LES CÔTÉS, TEL QU'INDIQUÉ, OU JUSQU'AU MATÉRIAU COMBUSTIBLE LE PLUS PROCHE PERMIS.
PIÈCES EN OPTION : VENTILATEUR (846-515), ALIMENTATION ÉLECTRIQUE : VOLTS 115,60 HZ, 2 AMPS; DIFFUSEUR AIRMATE, DISPOSITIF D'AIR EXTÉRIEUR, TIROIR À CENDRES, CATALYSEUR PIÈCE NO051-530.
CET APPAREIL AU BOIS COMPREND UN CATALYSEUR DE POSTCOMBUSTION QUI A BESOIN D'ÊTRE INSPECTÉ ET REMPLACÉ RÉGULIÈREMENT POUR UN FONCTIONNEMENT ADÉQUAT. LA RÉGLEMENTATION INTERDIT DE FAIRE FONCTIONNER CET APPAREIL DE CHAUFFAGE AU BOIS SI LES CONSIGNES D'UTILISATION CONTENUES DANS LE PRÉSENT MANUEL NE SONT PAS RESPECTÉES OU SI L'ÉLÉMENT CATALYTIQUE EST DÉSACTIVÉ OU RETIRÉ.
DANGER : RISQUE D'ÉLECTROCUTION. DÉBRANCHER L'ALIMENTATION ÉLECTRIQUE AVANT L'ENTRETIEN DE L'APPAREIL. NE PAS PLACER LE CORDON D'ALIMENTATION ÉLECTRIQUE AU-DESSOUS OU DEVANT L'APPAREIL.
ATTENTION : LE DÉPLACEMENT DES PIÈCES PEUT CAUSER DES BLESSURES. NE PAS FAIRE FONCTIONNER L'APPAREIL SANS LE VENTILATEUR.
ATTENTION : PIÈCES CHAUDES, NE PAS FAIRE FONCTIONNER L'APPAREIL SANS LA PORTE OU LA VITRE.
COMPOSANTS REQUIS POUR UNE INSTALLATION DANS UNE MAISON MOBILE : DISPOSITIF D'AIR EXTÉRIEUR ET UN DES CONNECTEURS À DOUBLE PAROI SUIVANTS.
AU CANADA : CONNECTEUR À DOUBLE PAROI HOMOLOGUÉ MODÈLES SECURITY DP, OU OLIVER MACLEOD PRO-VENT PV AVEC SYSTÈME DE CHEMINÉE HOMOLOGUÉ : MODÈLE DE SÉCURITÉ HOMOLOGUÉ SECURITY S2100+, ICC EXCEL 2100, SIMPSON DURA-PLUS HTC, SELKIRK SENTINAL CF.
AUX ÉTATS-UNIS : CONNECTEURS À DOUBLE PAROI HOMOLOGUÉS MODÈLES SECURITY DP, SELKIRK DS, OLIVER MCLEOD PRO VENT PV, SIMPSON DURANT VENT DVL, METAL FAB. RELIÉS À L'UN DES SYSTÈMES DE CHEMINÉE COMPATIBLES SUIVANTS : SELKIRK SURE-TEMP, PROJET NOVA TEMP, SECURITY SECURE TEMP ASH+, SECURITY SECURE TEMP S-2100+, METAL-FAB TEMP/GUARD 2100, AMERI-TECH HS, ICC EXCEL 2100. UTILISER LES PIÈCES DE CHEMINÉE COMME SPÉCIFIÉ DANS LES CONSIGNES D'INSTALLATION.

DATE OF MANUFACTURE

2017 ○ 2018 ○ 2019 ○ 2020 ○ 2021

JAN ☐ FEB ☐ MAR ☐ APR ☐ MAY ☐ JUN ☐ JUL ☐ AUG ☐ SEPT ☐ OCT ☐ NOV ☐ DEC ☐

CAUTION

HOT WHILE IN OPERATION DO NOT TOUCH. KEEP CHILDREN, CLOTHING AND FURNITURE AWAY. CONTACT MAY CAUSE SKIN BURNS. READ NAMEPLATE AND INSTRUCTIONS.

ATTENTION

CHAUD EN COURS DE FONCTIONNEMENT.
NE PAS TOUCHER. ÉLOIGNER LES ENFANTS, LES VÊTEMENTS ET LES MEUBLES DE L'APPAREIL. LE CONTACT AVEC L'APPAREIL PEUT OCCASIONNER DES BRÛLURES. LIRE CETTE ÉTIQUETTE ET LES CONSIGNES.

919-337b

Part #: 919-337b

Size: **12-5/8" H x 5-3/4" W (File at 100%)**
Color: **Everything printed black on grey except what is indicated is printed red on grey.**
Material: 2 ml silver matt polyester (DPM SMS)

Jan 13/14: Created draft.
Apr. 4/14: Updated as per Dave L
Apr. 16/14: Updated as per Dave L
May 06/15: Updated yrs. of manufacture/removed 1990 EPA info
Apr. 29/16: Updated yrs of manufacture 2017-2021
Dec. 18/18: Rev. B Updated Omni logo + add info to be 2020 compliant

REGENCY®
FIREPLACE PRODUCTS

Pro Series Freestanding Woodstove

Owners & Installation Manual

French Manual Download: https://bit.ly/3qvWvSf
Manuel en Français : https://bit.ly/3qvWvSf

www.regency-fire.com

MODEL: F3500

Tested by:
0219WS018S

Installer: Please complete the details on the back cover and leave this manual with the homeowner.
Homeowner: Please keep these instructions for future reference.

FPI FIREPLACE PRODUCTS INTERNATIONAL LTD. 6988 Venture St., Delta, BC Canada, V4G 1H4

Thank you for purchasing a
REGENCY FIREPLACE PRODUCT.

The pride of workmanship that goes into each of our products will give you years of trouble-free enjoyment. Should you have any questions about your product that are not covered in this manual, please contact the **REGENCY DEALER** in your area.

"This wood heater has a manufacturer set minimum low burn rate that must not be altered. It is against federal regulations to alter this setting or otherwise operate this wood heater in a manner inconsistent with operating instructions in this manual." Failure to follow the manual details can lead to smoke and CO emissions spilling into the home. It is recommended to have monitors in areas that are expected to generate CO such as heater fueling areas.

"U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards using cord wood." Tested and listed to ASTM E3053 Model Regency F3500 – 0.9g/hr.

"This manual describes the installation and operation of the Regency F3500 catalytic equipped wood heater. This heater meets the 2020 U.S. Environmental Protection Agency's crib wood emission limits for wood heaters. Under specific test conditions this heater has been shown to deliver heat at rates ranging from 10,704 BTU/hr. to 36,174 BTU/hr." Efficiency is determined using the B415 method resulting in lower and higher heat values. This heater generates the best efficiency when operated using well-seasoned wood and installed in the main living areas where the majority of the chimney is within the building envelope. "This wood heater contains a catalytic combustor, which needs periodic inspection and replacement for proper operation.

It is against federal regulation to operate this wood heater in a manner inconsistent with operating instructions in this manual, or if the catalytic element is deactivated or removed."

CAUTION: BURN UNTREATED WOOD ONLY. OTHER MATERIALS SUCH AS WOOD PRESERVATIVES, METAL FOILS, COAL, PLASTIC,GARBAGE, SULPHUR OR OIL MAY DAMAGE THE CATALYST

"This heater is designed to burn natural wood only. Higher efficiencies and lower emissions generally result when burning air dried seasoned hardwoods, as compared to softwoods or to green or freshly cut hardwoods."

DO NOT BURN:

- Treated wood
- Coal
- Garbage
- Cardboard
- Solvents
- Colored Paper
- Trash
- Lawn clippings or yard waste
- Materials containing rubber including tires
- Materials containing plastic
- Waste petroleum products , paints or paint thinners or asphalt products
- Materials containing asbestos
- Construction or demolition debris
- Railroad ties
- Manure or animal remains
- Saltwater driftwood or other previously salt water saturated materials
- Unseasoned wood
- Paper products, cardboard, plywood or particle board. The prohibition against burning these materials does not prohibit the use of fire starters made from paper, cardboard, saw dust, wax and similar substances for the purpose of starting a fire in a wood heater.

Burning these materials may result in release of toxic fumes or render the heater ineffective and cause smoke.

The authority having jurisdiction (such as Municipal Building Department, Fire Department, Fire Prevention Bureau, etc.) should be consulted before installation to determine the need to obtain a permit.

Note: Due to the high efficiency of the F3500 unit. **Double wall pipe** is recommended from the stove top to either wall or roof exit. A minimum of 36" vertical rise is required prior to using any elbows.

This unit must be connected to either a listed factory built chimney suitable for use with solid fuels and conforming to, ULC629 in Canada or UL-103HT in the United States of America. or code approved masonry chimney with flue liner.

F3500 is tested and certified to ULC-S627-00 and UL1482-2011 (R 2015).

SAVE THESE INSTRUCTIONS

NATIONAL FIREPLACE INSTITUTE NFI CERTIFIED www.nficertified.org

We recommend that our products be installed and serviced by professionals who are certified in the U.S. by the National Fireplace Institute® (NFI) or in Canada by Wood Energy Technical Training (WETT).

Wood Energy Technical Training

WARNING: Cancer and Reproductive Harm
www.P65Warnings.ca.gov
919-874

table of contents

CAUTION: To avoid burns or wood splinters, when opening/closing the fuel door or adding wood to the fire, You should always wear appropriate protective gloves to protect your hands from the heat being emitted from this fireplace.

safety decal

This is a copy of the label that accompanies each Regency Freestanding Woodstove (F3500). We have printed a copy of the contents here for your review.

NOTE: Regency units are constantly being improved. Check the label on the unit and if there is a difference, the label on the unit is the correct one.

SAFETY LABEL FOR F3500

431

0219WS018S

LISTED ROOM HEATER, SOLID FUEL TYPE, ALSO FOR USE IN MOBILE HOME INSTALLATION

DO NOT REMOVE THIS LABEL

431

MODEL: REGENCY FREESTANDING STOVE - F3500

TESTED TO: UL-1482 -2011 (R 2015) / ULC-S627-00

U.S. ENVIRONMENTAL PROTECTION AGENCY CERTIFIED TO COMPLY WITH 2020 PARTICULATE EMISSION STANDARDS USING CORD WOOD." TESTED TO ASTM E3053. MODEL REGENCY F3500 – 0.9G /HR. THIS WOOD HEATER NEEDS PERIODIC INSPECTION AND REPAIR FOR PROPER OPERATION. CONSULT THE OWNER'S MANUAL FOR FURTHER INFORMATION. IT IS AGAINST FEDERAL REGULATIONS TO OPERATE THIS WOOD HEATER IN A MANNER INCONSISTENT WITH THE OPERATING INSTRUCTIONS IN THE OWNER'S MANUAL.

CERTIFIÉ CONFORME AUX NORMES 2020 DU U.S. ENVIRONMENTAL PROTECTION AGENCY EN MATIÈRE D'ÉMISSION DE PARTICULES DE BOIS AVEC DU BOIS DE CORDE". APPROUVÉ ASTM E3053. MODÈLE REGENCY F3500 – 0,9 G /H. CET APPAREIL DE CHAUFFAGE AU BOIS DOIT ÊTRE INSPECTÉ PÉRIODIQUEMENT ET RÉPARÉ POUR FONCTIONNER CORRECTEMENT. CONSULTER LE MANUEL D'INSTALLATION POUR PLUS D'INFORMATION. LA RÉGLEMENTATION FÉDÉRALE INTERDIT DE FAIRE FONCTIONNER UN TEL APPAREIL SI LES CONSIGNES D'UTILISATION CONTENUES DANS LE PRÉSENT MANUEL NE SONT PAS RESPECTÉES.

INSTALL AND USE ONLY IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION AND OPERATING INSTRUCTIONS. CONTACT LOCAL BUILDING OR FIRE OFFICIALS ABOUT RESTRICTIONS AND INSTALLATION INSPECTION IN YOUR AREA. USE 6"(152MM) DIAMETER MINIMUM 24 MSG BLACK OR 26 MSG BLUED STEEL CONNECTOR WITH LISTED UL103 HT or ULC5629 FACTORY-BUILT CHIMNEY SUITABLE FOR USE WITH SOLID FUELS OR MASONRY CHIMNEY.

SEE LOCAL BUILDING CODE AND MANUFACTURER'S INSTRUCTIONS FOR PRECAUTIONS REQUIRED FOR PASSING A CHIMNEY THROUGH A COMBUSTIBLE WALL OR CEILING. DO NOT PASS CHIMNEY CONNECTOR THROUGH COMBUSTIBLE WALL OR CEILING. DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE.

CAUTION: BURNING OF MATERIAL OTHER THAN THE SPECIFIED FUELS MAY MAKE THE CATALYST IN THE COMBUSTOR INACTIVE. THE COMBUSTOR IS FRAGILE, HANDLE CAREFULLY.

THE PERFORMANCE OF THE CATALYTIC DEVICE OR ITS' DURABILITY HAS NOT BEEN EVALUATED AS PART OF THE CERTIFICATION.

INSTALLER ET UTILISER SEULEMENT SELON LES INSTRUCTIONS D'INSTALLATION ET D'UTILISATION DU FABRICANT.

CONTACTER LES RESPONSABLES DU BÂTIMENT OU DU SERVICE-INCENDIE DE VOTRE RÉGION POUR CONNAÎTRE LES RESTRICTIONS ET EXIGENCES D'INSPECTION DANS VOTRE RÉGION. UTILISER UN CONNECTEUR D'UN DIAMÈTRE MINIMAL DE 152 MM (6 PO) 24 MSG EN ACIER NOIR OU 26 MSG EN ACIER BRONZÉ AVEC CHEMINÉE PRÉFABRIQUÉE HOMOLOGUÉE CONÇUE POUR UTILISATION AVEC COMBUSTIBLES SOLIDES OU UNE CHEMINÉE DE MAÇONNERIE.

VOIR LE CODE DU BÂTIMENT LOCAL ET LES INSTRUCTIONS DU FABRICANT CONCERNANT LES PRÉCAUTIONS EXIGÉES POUR INSTALLER UNE CHEMINÉE TRAVERSANT UN MUR OU PLAFOND EN MATÉRIAUX COMBUSTIBLES. NE FAITES PAS TRAVERSER LE CONNECTEUR DE CHEMINÉE DANS UN MUR OU PLAFOND EN MATÉRIAUX COMBUSTIBLES. NE RACCORDEZ PAS CE POÊLE À BOIS À UN CONDUIT DE CHEMINÉE DESSERVANT UN AUTRE APPAREIL.

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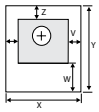
FLOOR PROTECTION*



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REGENCY

MANUFACTURED BY:

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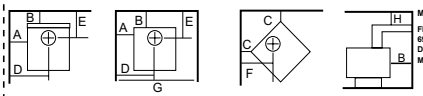

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À UTILISER SEULEMENT AVEC UN COMBUSTIBLE DE BOIS SOLIDE. L'UTILISATION D'AUTRES COMBUSTIBLES PEUT ENDOMMAGER L'APPAREIL DE CHAUFFAGE ET PRÉSENTER UN DANGER. NE PAS OBSTRUER LES OUVERTURES DE L'AIR DE COMBUSTION. FAIRE FONCTIONNER SEULEMENT LORSQUE LES BRIQUES SONT EN PLACE. RISQUE DE FUMÉE ET DE DÉBORDEMENT DES FLAMMES. FAIRE FONCTIONNER SEULEMENT AVEC LES PORTES COMPLÈTEMENT FERMÉES. NE PAS UTILISER DE GRILLE NI SURÉLEVER LE FOYER. FAIRE LE FEU DIRECTEMENT SUR L'ÂTRE. NE PAS SURCHAUFFER - SI LE POÊLE OU LE CONNECTEUR DE CHEMINÉE ROUGEOIE, IL Y A SURCHAUFFE. INSPECTER ET FAIRE RAMONER FRÉQUEMMENT LA CHEMINÉE ET LE CONNECTEUR, DANS CERTAINES CONDITIONS D'UTILISATION, UN DÉPÔT DE CRÉOSOTE PEUT SE FORMER RAPIDEMENT. TENIR LES MEUBLES ET TOUT AUTRE MATÉRIAU COMBUSTIBLE À DISTANCE DU FEU. REMPLACER LA VITRE SEULEMENT PAR UNE VITRE NÉOCÉRAM. LE PLANCHER COMBUSTIBLE DOIT ÊTRE PROTÉGÉ PAR UN MATÉRIAU NON COMBUSTIBLE SE PROLONGEANT SOUS L'APPAREIL, À L'AVANT ET SUR LES CÔTÉS, TEL QU'INDIQUÉ, OU JUSQU'AU MATÉRIAU COMBUSTIBLE LE PLUS PROCHE PERMIS.
PIÈCES EN OPTION : VENTILATEUR (846-515), ALIMENTATION ÉLECTRIQUE : VOLTS 115,60 HZ, 2 AMPS; DIFFUSEUR AIRMATE, DISPOSITIF D'AIR EXTÉRIEUR, TIROIR À CENDRES; CATALYSEUR PIÈCE NO051-530.
CET APPAREIL AU BOIS COMPREND UN CATALYSEUR DE POSTCOMBUSTION QUI A BESOIN D'ÊTRE INSPECTÉ ET REMPLACÉ RÉGULIÈREMENT POUR UN FONCTIONNEMENT ADÉQUAT. LA RÉGLEMENTATION INTERDIT DE FAIRE FONCTIONNER CET APPAREIL DE CHAUFFAGE AU BOIS SI LES CONSIGNES D'UTILISATION CONTENUES DANS LE PRÉSENT MANUEL NE SONT PAS RESPECTÉES OU SI L'ÉLÉMENT CATALYTIQUE EST DÉSACTIVÉ OU RETIRÉ.
DANGER : RISQUE D'ÉLECTROCUTION. DÉBRANCHER L'ALIMENTATION ÉLECTRIQUE AVANT L'ENTRETIEN DE L'APPAREIL. NE PAS PLACER LE CORDON D'ALIMENTATION ÉLECTRIQUE AU-DESSOUS OU DEVANT L'APPAREIL.
ATTENTION : LE DÉPLACEMENT DES PIÈCES PEUT CAUSER DES BLESSURES. NE PAS FAIRE FONCTIONNER L'APPAREIL SANS LE VENTILATEUR.
ATTENTION : PIÈCES CHAUDES, NE PAS FAIRE FONCTIONNER L'APPAREIL SANS LA PORTE OU LA VITRE.
COMPOSANTS REQUIS POUR UNE INSTALLATION DANS UNE MAISON MOBILE : DISPOSITIF D'AIR EXTÉRIEUR ET UN DES CONNECTEURS À DOUBLE PAROI SUIVANTS.
AU CANADA : CONNECTEUR À DOUBLE PAROI HOMOLOGUÉ MODÈLES SECURITY DP, OU OLIVER MACLEOD PRO-VENT PV AVEC SYSTÈME DE CHEMINÉE HOMOLOGUÉ : MODÈLE DE SÉCURITÉ HOMOLOGUÉ SECURITY S2100+, ICC EXCEL 2100, SIMPSON DURA-PLUS HTC, SELKIRK SENTINAL CF.
AUX ÉTATS-UNIS : CONNECTEURS À DOUBLE PAROI HOMOLOGUÉS MODÈLES SECURITY DP, SELKIRK DS, OLIVER MCLEOD PRO VENT PV, SIMPSON DURANT VENT DVL, METAL FAB. RELIÉS À L'UN DES SYSTÈMES DE CHEMINÉE COMPATIBLES SUIVANTS : SELKIRK SURE-TEMP, PROJET NOVA TEMP, SECURITY SECURE TEMP ASH+, SECURITY SECURE TEMP S-2100+, METAL-FAB TEMP/GUARD 2100, AMERI-TECH HS, ICC EXCEL 2100. UTILISER LES PIÈCES DE CHEMINÉE COMME SPÉCIFIÉ DANS LES CONSIGNES D'INSTALLATION.

CAUTION

HOT WHILE IN OPERATION DO NOT TOUCH. KEEP CHILDREN, CLOTHING AND FURNITURE AWAY. CONTACT MAY CAUSE SKIN BURNS. READ NAMEPLATE AND INSTRUCTIONS.

ATTENTION

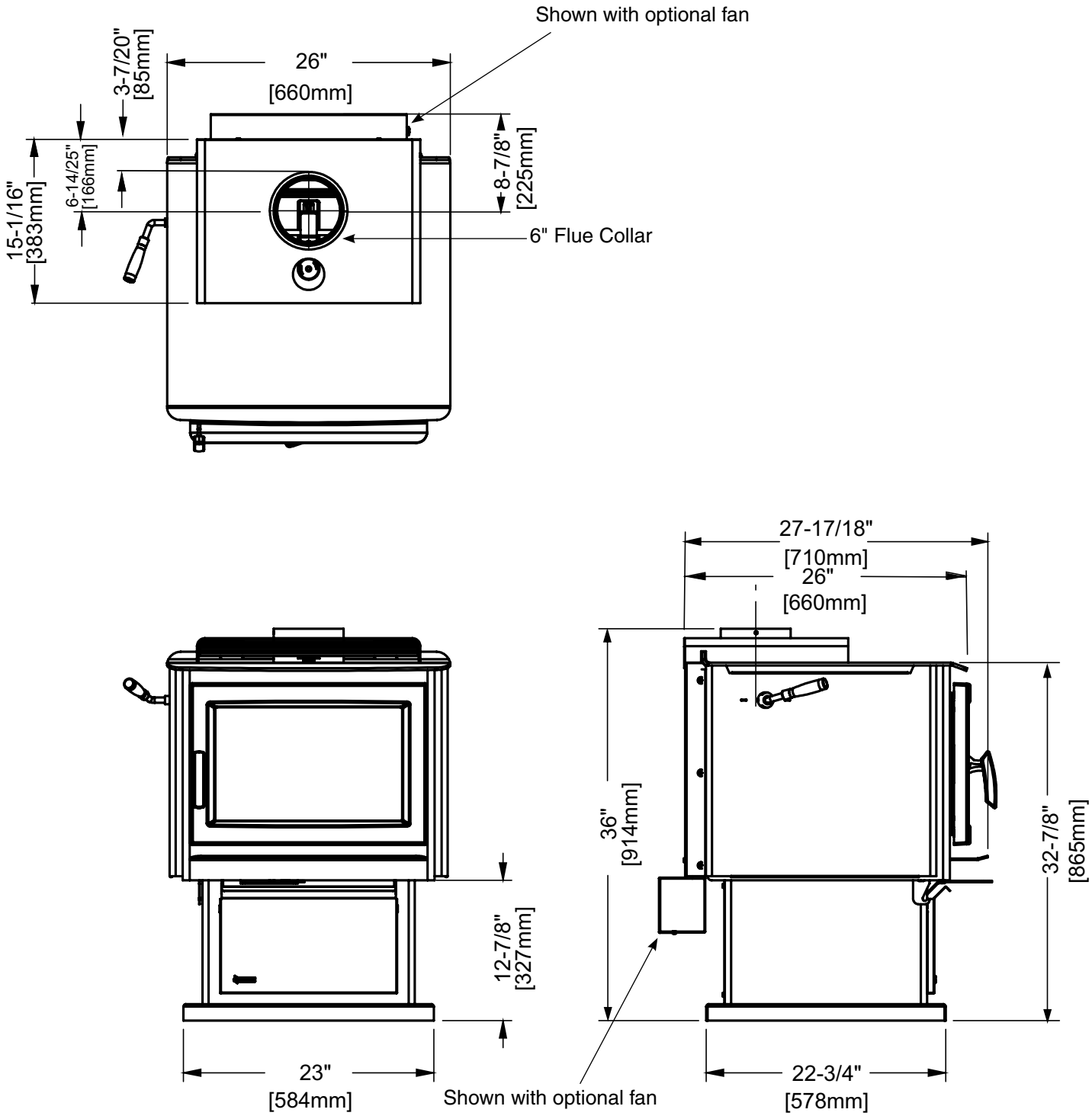
CHAUD EN COURS DE FONCTIONNEMENT.
NE PAS TOUCHER. ÉLOIGNER LES ENFANTS, LES VÊTEMENTS ET LES MEUBLES DE L'APPAREIL. LE CONTACT AVEC L'APPAREIL PEUT OCCASIONNER DES BRÛLURES. LIRE CETTE ÉTIQUETTE ET LES CONSIGNES.

919-337b

DATE OF MANUFACTURE

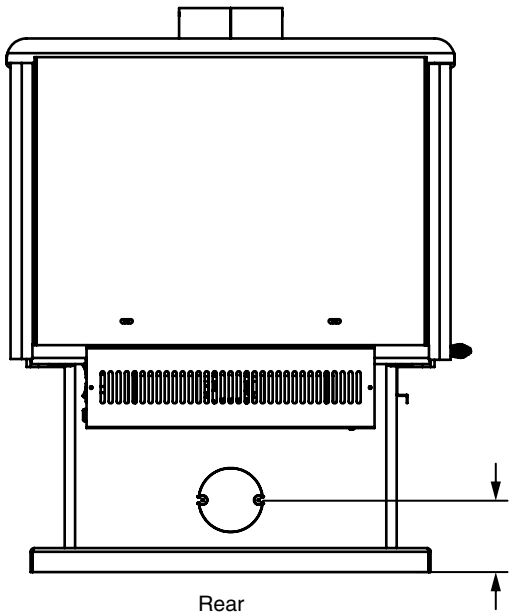
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
2021 ○	2022 ○	2023 ○	2024 ○	2025 ○							

UNIT DIMENSIONS



ALL PICTURES / DIAGRAMS SHOWN THROUGHOUT THIS MANUAL ARE FOR ILLUSTRATION PURPOSES ONLY. ACTUAL PRODUCT MAY VARY DUE TO PRODUCT ENHANCEMENTS.

WOOD STOVE OUTSIDE AIR DIMENSIONS



Rear

With pedestal from base of unit to centerline
5-1/2" (138mm)

RESIDENTIAL INSTALLATION

1) Please read this entire manual before you install and use your new woodstove. Failure to follow instructions may result in property damage, bodily injury or even death. Be aware that local Codes and Regulations may override some items in this manual. Check with your local inspector.

2) Select a position for your Regency Stove. Consult the minimum clearance chart for your model and set the stove in place.

3) To insure vertical alignment, suspend a plumb bob from the ceiling over the exact center of your stove flue and mark a spot on the ceiling to indicate the center of the chimney.

4) Check that the area above the ceiling is clear for cutting. Re-confirm the clearance from the stove to combustibles to insure that they are within the prescribed limits.

5) This woodstove must be connected to a UL 103 HT (ULC S629) listed chimney or a code approved masonry chimney with a flue liner.

Space heater is to be connected to a factory built chimney conforming to CAN/ULC-5629 standard for 650C factory built chimneys. The chimney requirement is 6", refer to appropriate sections in this manual for specifics.

6) Install chimney according to chimney manufacturers instructions. The performance of your woodstove is governed to a very large part by the chimney system. Too short a chimney can cause difficult start-up, dirty glass, back smoking when door is open, and even reduced heat output.

Too tall a chimney may prompt excessive draft which can result in very short burn times and excessive heat output. The use of an inexpensive flue pipe damper may be helpful in reducing excessive draft.

CAUTION: The chimney should be the same size as the 6" flue outlet on the stove. The chimney must be listed as suitable for use with solid fuels. For other types of chimneys check with your local building code officials. Do not confuse a chimney with a type "B" Venting System used for gas appliances as suitable for a wood burning appliance. For Mobile Home installations refer to that section within this manual.

7) Mark the location of the pedestal base or legs on the floor, then move the stove aside and mark the position of the floor protector.

8) The floor protector must be of non-combustible material and must extend 16" (406mm) in front of the door opening and 8" (203mm) to the sides and rear of the unit. Some areas may require a larger size floor protector. See your local inspector. For outside air installation refer to Mobile Home installation instructions within this manual.

NOTE: In Canada, floor protection must extend 18" (450mm) to the front and 8" (203mm) to each side and back of the stove.

9) When the floor protection is complete, position the stove with the flue collar centered under the installed chimney.

ROOM AIR - IMPORTANT

For installation using room air for combustion, remove knockout from the pedestal. Mobile home installations require the use of outside air.
Fresh air is important - if heater is starved for air caused by exhaust fans or icing, the unit will not operate properly.

On pedestal units there are two locations where outside air may be adapted to the unit. If using the bottom of the pedestal, do not remove knockout from the rear of the pedestal. Only remove rear knockout if outside air will be brought in from the rear.

Note: Once the knockout is removed there are two tabs remaining. Bend both tabs out for ease of installation of outside air kit.

10) In areas with frequent seismic activity, Regency recommends that your unit is secured to the floor by using the bolt down holes inside the pedestal (the same ones used in Mobile Home installations).

11) For residential installations 6" (single wall OK) double wall chimney, the chimney connector must be at least 24 gauge steel. Do not use galvanized pipe. For Mobile Home installation refer to the Mobile Home installation instructions within this manual.

12) DO NOT CONNECT THIS UNIT TO A CHIMNEY SERVING ANOTHER APPLIANCE.

13) A chimney connector cannot pass through an attic or roof space, closet or similar concealed space, or a floor, ceiling, wall or partition of combustible construction. In Canada, if passage through a wall, or partition of combustible construction is desired, the installation shall conform to CAN/CSA-B365, Installation Code for Solid-Fuel-Burning Appliances and Equipment.

14) Your Regency Woodstove is not to be connected to any air distribution duct.

Emissions from burning wood or gas could contain chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

CAUTION:
Do not alter or makeshift chimney or install. Install as per Manual.

MODULAR INSTALLATION OPTIONS

WARNING: ONLY USE SPECIFIED COMPONENTS.
The following items are required when assembling your Regency Stove. F3500 unit - the Rear Heat Deflector is supplied with the stove, but if you choose not to use it you must use the Airmate instead.

Modular Part	See the Minimum Clearance to Combustible Materials chart in the Installation section of this manual
F3500 Airmate OR Rear Heat Deflector	Convection heat with Airmate vs. Radiant Heat with Rear Heat Deflector. The Airmate pushes heat forward out into the room, the Rear Heat Deflector deflects the heat upward. Refer to the Installation sections within this manual.
OPTIONS: These can be installed at time of installation or added later:	
Blower/Fan	Adding the blower will increase the area heated by the stove, it can move warm air beyond the room where the stove
Ash Drawer Kit	Adding the Ash Drawer Kit makes cleaning ashes out of the stove easier and cleaner (refer to Bottom Shield Ash Drawer Kit, Installation section).
Airmate	The Airmate pushes heat forward out into the room.
Outside Air Kit	Draw combustion air from the outside of dwelling.

STOVE ASSEMBLY PRIOR TO INSTALLATION

The F3500 unit requires the pedestal attached to the base. The F3500 stove requires either the Airmate or Rear Heat Deflector on top of the stove. Clearances to combustible materials vary depending on whether the Airmate or rear heat deflector is installed, so be sure to check the Minimum Clearances, Installation section.

Airmate Assembly for F3500

1) The Airmate sits on top of the stove with the slots in the sides fitting over the curved deflector on the rear stove top. See diagram 1. Discard the Rear Heat Deflector that is supplied with the unit, it is not required if the Airmate is installed.

2) Center the Airmate and push it forward to the front of the stove. The back of the Airmate should be level with the back and sides of the rear heat shield. See Diagrams 2 & 3.

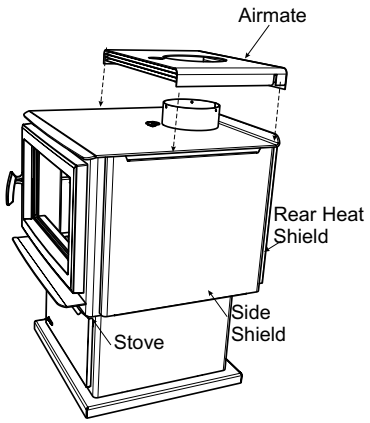


Diagram 1

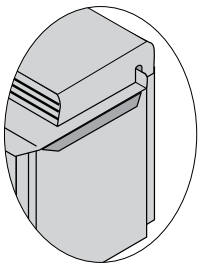


Diagram 2

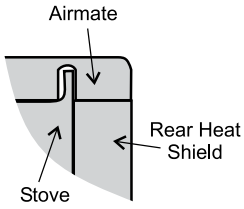


Diagram 3

Rear Heat Deflector Assembly for F3500

The rear heat deflector is supplied with the stove and must be installed unless the optional Airmate has been selected. It stops the heat radiated from the flue collar from overheating the rear wall. The rear heat deflector is installed on top of the rear heat shield, as shown in Diagram 4.

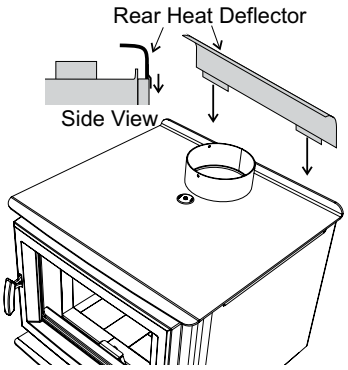
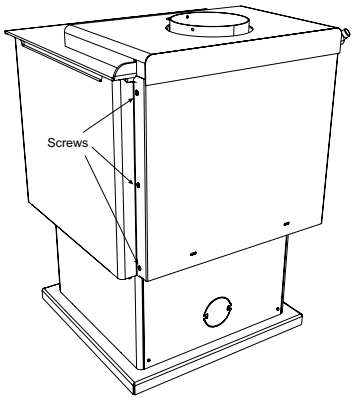


Diagram 4

Side Shield Adjustment

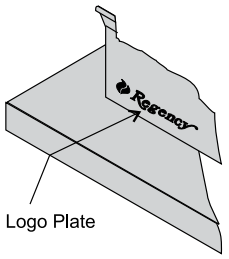
The left and right side shields are lowered for shipping and handling. It allows for a handhold on the top of the stove. Before placing in the Step Stove in its final position, the side shields must be raised.

Loosen the screws on the rear on the stove (3 per side), slide the side panel up as far as possible and then secure by tightening the screws.



Logo Installation

1) Push the Regency logo into the two holes in the front bottom left corner of the pedestal cover plate.



Note: Any paint touch up should be done prior to placing logo on pedestal.

2) If not using ash drawer, then cover plate must be installed.

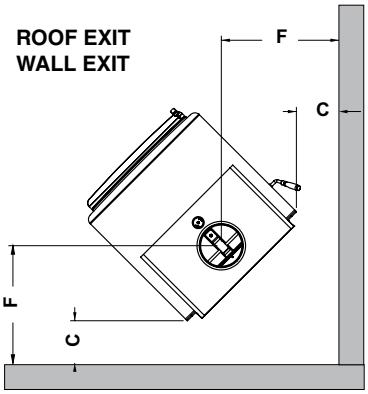
MINIMUM CLEARANCE TO COMBUSTIBLE MATERIALS

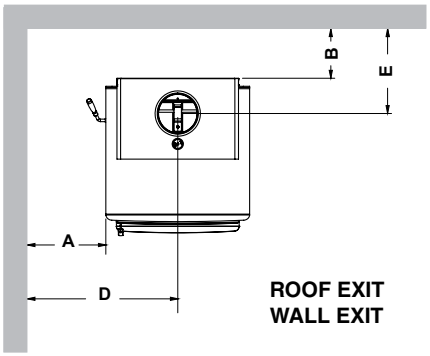
Please read the section below carefully as clearances depend on whether the Airmate or the Rear Heat Deflector is installed on the stove. Measurements "From Unit" are from the top plate of the stove to a side wall or to a corner, and from the rear heat shield to a back wall.

Clearances may only be reduced by means approved by the regulatory authority.

Note: Minimum ceiling height - 83" (2108mm)

NOTE: This clearance is also required for air space between the appliance and wall/ceiling.





NOTE: Be aware that local Codes and Regulations may override some clearances listed in this manual. Check with your local inspector.

NOTE: Clearances to combustibles are for the safety of the property. To avoid overheating and damaging the appliance these clearances should be maintained for non-combustibles also.

Residential Installation "C" Vent (Single Wall Pipe)

		A	B	C	D	E	F
F3500	with Airmate or Rear Deflector	11" 279mm	9-1/2" 241mm	8" 203mm	24" 610mm	16" 406mm	20-1/2" 521mm

Residential Close Clearance (To be installed with required pipe components) Listed Double Wall Pipe
When the stove is installed as a close clearance residential unit, a listed double wall connector is required from the stove collar to the ceiling level.

		A	B	C	D	E	F
F3500	with Airmate or Rear Deflector	11" 279mm	9-1/2" 241mm	8" 203mm	24" 610mm	16" 406mm	20-1/2" 521mm

Mobile Home Close Clearance (To be installed with required pipe components) Listed Double Wall Pipe When the stove is installed as a close clearance residential unit, a listed double wall connector is required from the stove collar to the ceiling level. Refer to Mobile Home Installation in this manual.

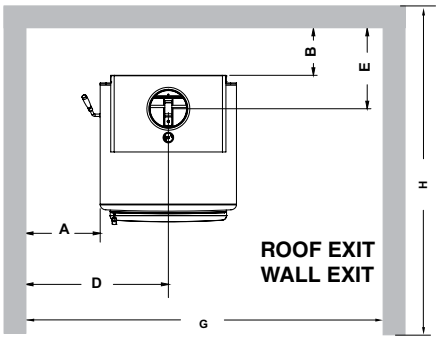
		A	B	C	D	E	F
F3500	with Airmate or Rear Deflector	11" 279mm	9-1/2" 241mm	8" 203mm	24" 610mm	16" 406mm	20-1/2" 521mm

Minimum Alcove Clearance to Combustible Materials

The Regency Freestanding models have been alcove approved and must be installed with a listed double wall connector to the ceiling level.

Note: Minimum alcove ceiling height - 83" (2108 mm) Vertical Termination}
H = Maximum depth of alcove - 48" (1219mm)
G= Minimum width of alcove - 60" (1524mm)

NOTE: This clearance is also required for air space between the appliance and wall/ceiling.



FLOOR PROTECTION (Ember Protection Only Required)

A combustible floor must be protected by non-combustible material (like tile, concrete board, or certified to UL-1618 or as defined by local codes) extending beneath the heater and a minimum of 8" (203mm) from each side and minimum 16" (406mm) from the front face of the stove and minimum 6" (or the rear clearance to combustibles whichever is smaller) from the rear of the stove.

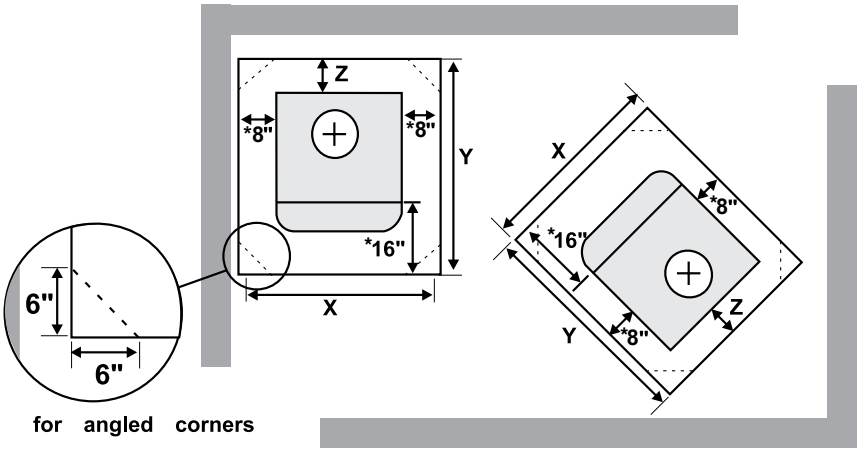
NOTE: This clearance is also required for air space between the appliance and wall/ceiling. Where the appliance is installed less than 8" from a rear wall, the ember pad only needs to extend to the base of the wall based on the clearances noted in this manual.

When installed with horizontal venting, non-combustible floor protection must beneath the flue pipe and extend 2" (51mm) beyond each side.

Minimum Overall Width (X) of Floor Protector for all installations:

Stove	F3500	33" (838mm)

*Measurement is taken from fuel door opening.



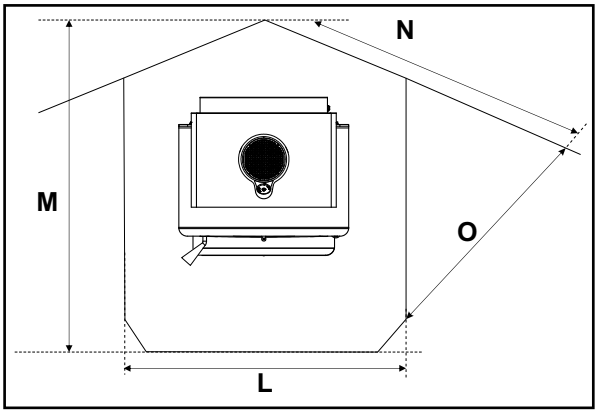
NOTE: USA clearances shown above.

NOTE: In Canada, floor protection must extend 18" (450mm) to the front and 8" (203mm) to each side (measured from fuel door) and back of the stove.

Minimum Overall Depth (Y) of Floor Protector						
Unit	**Residential Close Clearance**		**Mobile Home Close Clearance**		**Alcove**	
F3500	**Y**	**Z**	Y	**Z**	Y	**Z**
USA	46-1/2"	8"	46-1/2	8"	46-1/2	8"
Canada	48-1/2"	8"	48-1/2"	8"	48-1/2"	8"

The rear clearance to combustibles is less than 6" (for corner installations the rear corners may be angled to take advantage of the closer clearances.

Minimum Overall Depth (Y) of Floor Protector - Corner Hearth Reference only when hearth pad is installed to rear wall at minimum pipe clearances.				
	Hearth Depth			
F3500	**L**	**M**	**N**	**O**
Residential Installation "C" Vent (Single Wall)				
Canada	33" (838mm)	65" (1651mm)	57-9/16" (1461mm)	25-3/4" (654mm)
USA	33" (838mm)	63" (1600mm)	56-1/8" (1425mm)	24-5/16" (618mm)
Residential Close Clearance (To be installed with required pipe components)				
Canada	33" (838mm)	65" (1651mm)	57-9/16" (1461mm)	25-3/4" (654mm)
USA	33" (838mm)	63" (1600mm)	56-1/8" (1425mm)	24-5/16" (618mm)



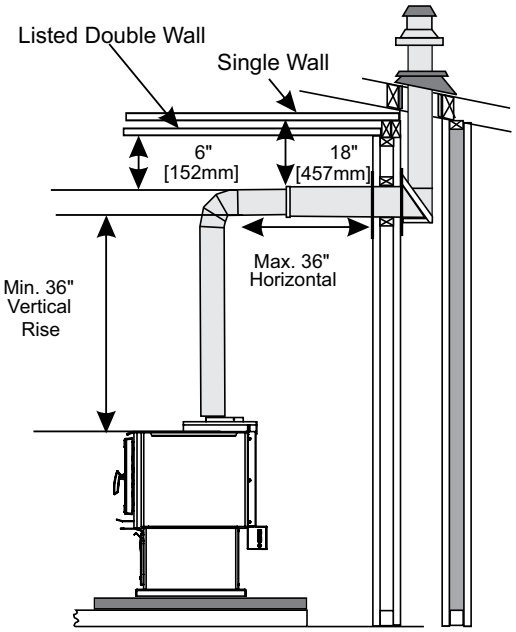
WALL EXIT CLEARANCE FACTORY BUILT CHIMNEY

When a metal prefabricated chimney is used, the manufacturer's installation instructions must be followed. You must also purchase and install the ceiling support package or wall pass-through and "T" section package, firestops (where needed), insulation shield, roof flashing, chimney cap, etc. Maintain proper clearance to the structure as recommended by the manufacturer. The chimney must be the required height above the roof or other obstructions for safety and proper draft operation.

Minimum vertical of 36" before any offset.
Horizontal Maximum of 36" with 1/4" rise per foot.

NOTE: Recommend using 2-45º instead of 90º to improve draft and performance.

Note: Minimum ceiling height roof - 83" (2108mm)

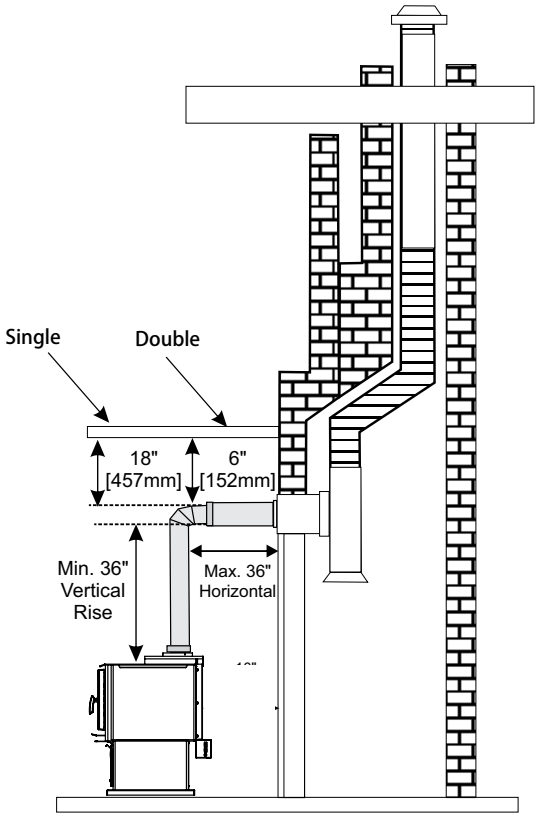


MASONRY FIREPLACE

There are listed kits available to connect a stove to a masonry fireplace. The kit is an adapter that is installed at the location of the fireplace damper. The existing damper may have to be removed to allow installation.

Minimum vertical of 36" before any offset.
Horizontal Maximum of 36" with 1/4" rise per foot.

NOTE: Recommend using 2-45º instead of 90º to improve draft and performance.



NOTE: Only a 6" and or 5.5" liner may be used when relining the masonry chimney. Do not increase/decrease size of the liner as this could result in poor performance, over firing and or dangerous operating conditions which may void your warranty.

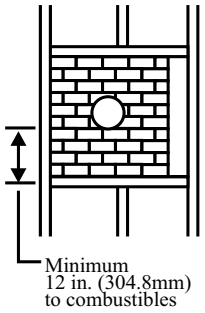
Do not use or add a pipe damper as this will result in poor performance, over firing and or dangerous operating conditions which may void your warranty. This appliance already has a bypass damper in place.

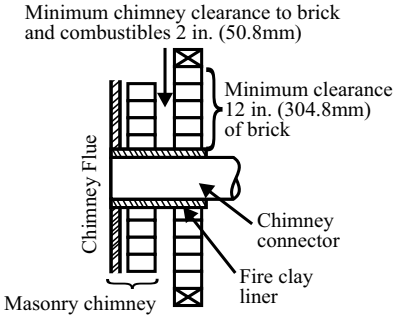
A minimum vertical rise of 36 inches is required from top of stove collar prior to having any offset. It is recommended that 45º elbows be used instead of a 90º elbow to improve draft and performance. If not adhered to this, it will result in poor performance overfiring and or dangerous operating conditions which may void your warranty.

COMBUSTIBLE WALL CHIMNEY CONNECTOR PASS-THROUGHS

Method A: 12" (304.8 mm) Clearance to Combustible Wall Member:

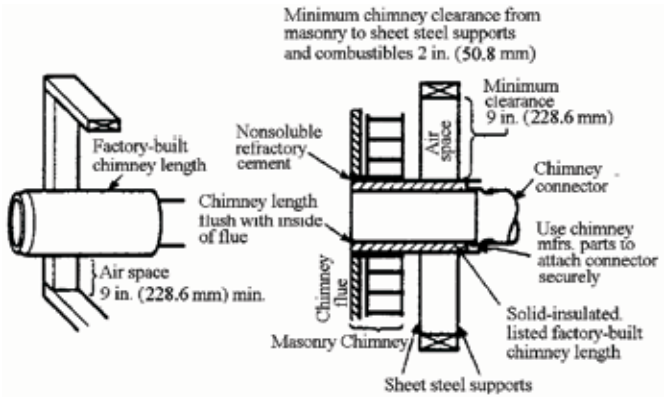
Using a minimum thickness 3.5" (89 mm) brick and a 5/8" (15.9 mm) minimum wall thickness clay liner, construct a wall pass-through. The clay liner must conform to ASTM C315 (Standard Specification for Clay Fire Linings) or its equivalent. Keep a minimum of 12" (304.8 mm) of brick masonry between the clay liner and wall combustibles. The clay liner shall run from the brick masonry outer surface to the inner surface of the chimney flue liner but not past the inner surface. Firmly grout or cement the clay liner in place to the chimney flue liner.





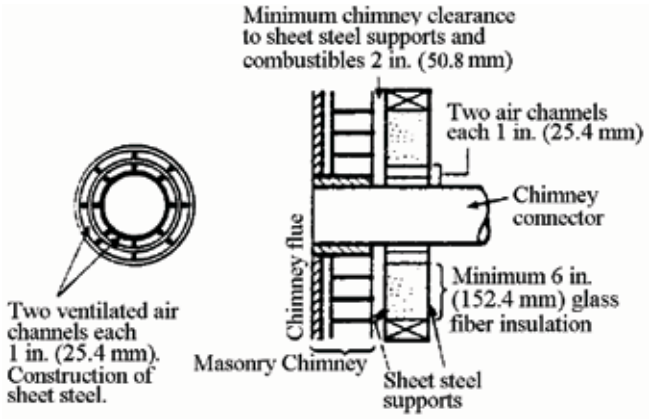
Method B: 9" (228.6 mm) Clearance to Combustible Wall Member:

Using a 6" (152.4 mm) inside diameter, listed, factory-built Solid-Pak chimney section with insulation of 1" (25.4 mm) or more, build a wall pass-through with a minimum 9" (228.6 mm) air space between the outer wall of the chimney length and wall combustibles. Use sheet metal supports fastened securely to wall surfaces on all sides, to maintain the 9" (228.6 mm) air space. When fastening supports to chimney length, do not penetrate the chimney liner (the inside wall of the Solid-Pak chimney). The inner end of the Solid-Pak chimney section shall be flush with the inside of the masonry chimney flue, and sealed with a non-water soluble refractory cement. Use this cement to also seal to the brick masonry penetration.



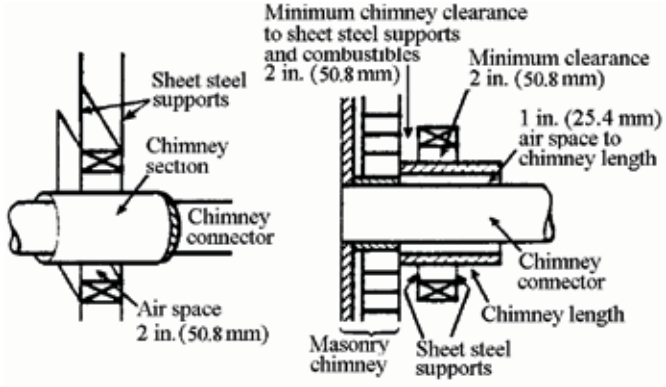
Method C: 6" (152.4 mm) Clearance to Combustible Wall Member:

Starting with a minimum 24 gage (.024" [.61 mm]) 6" (152.4 mm) metal chimney connector, and a minimum 24 gage ventilated wall thimble which has two air channels of 1" (25.4 mm) each, construct a wall pass-through. There shall be a minimum 6" (152.4) mm separation area containing fiberglass insulation, from the outer surface of the wall thimble to wall combustibles. Support the wall thimble, and cover its opening with a 24-gage minimum sheet metal support. Maintain the 6" (152.4 mm) space. There should also be a support sized to fit and hold the metal chimney connector. See that the supports are fastened securely to wall surfaces on all sides. Make sure fasteners used to secure the metal chimney connector do not penetrate chimney flue liner.



Method D: 2" (50.8 mm) Clearance to Combustible Wall Member:

Start with a solid-pak listed factory built chimney section at least 12" (304 mm) long, with insulation of 1" (25.4 mm) or more, and an inside diameter of 6" (2 inches [51 mm] larger than the 6" [152.4 mm] chimney connector). Use this as a pass-through for a minimum 24-gage single wall steel chimney connector. Keep solid-pak section concentric with and spaced 1" (25.4 mm) off the chimney connector by way of sheet metal support plates at both ends of chimney section. Cover opening with and support chimney section on both sides with 24 gage minimum sheet metal supports. See that the supports are fastened securely to wall surfaces on all sides. Make sure fasteners used to secure chimney flue liner.



STEP-BY-STEP CHIMNEY AND CONNECTOR INSTALLATION

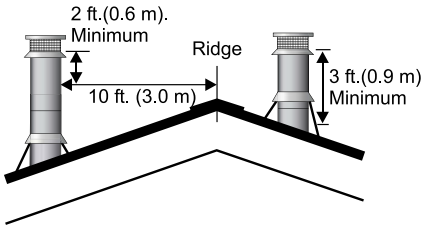
Note: These are a generic set of chimney installation instructions. Always follow the manufacturers own instructions explicitly. Verify the Minimum Recommended Heights for Woodstove Flue (Table 1 in the Installation section).

1. With your location already established, cut and frame the roof hole. It is recommended that no ceiling support member be cut for chimney and support box installation. If it is necessary to cut them, the members must be made structurally sound.

2. Install radiant shield and support from above.

3. Stack the insulated pipe onto your finish support to a minimum height of 3 feet above the roof penetration, or 2 feet above any point within 10 feet measured horizontally. There must be at least 3 feet of chimney above the roof level.

NOTE: Ensure each section of chimney is positively attached and secured.



Note: Increasing the chimney height above this minimum level will sometimes help your unit to "breathe" better by allowing a greater draft to be created. This greater draft can decrease problems such as, difficult start-ups, back-smoking when door is open, and dirty glass. It might be sufficient to initially try with the minimum required height, and then if problems do arise add additional height at a later date.

4. Slide the roof flashing over your chimney and seal the flashing to the roof with roofing compound. Secure the flashing to your roof with nails or screws.

5. Place the storm collar over the flashing, sealing the joints with a silicone caulking.

6. Fasten the raincap with spark screens (if required) to the top of your chimney.

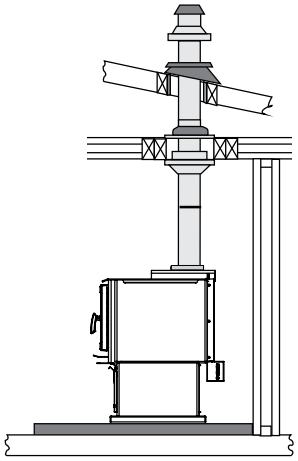
7. To complete your chimney installation, install the single wall or double wall connector pipe from the stove's flue collar to the chimney support device.

NOTE: When attaching the chimney to the appliance, ensure a minimum of two (2) screws are used to establish a snug fit.

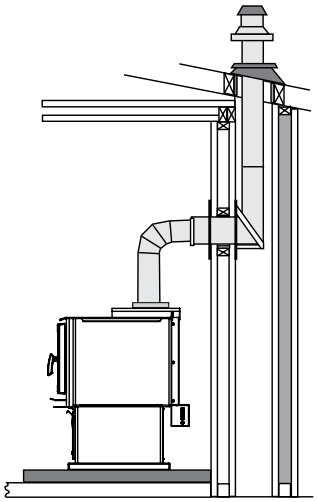
8. If you are using a horizontal connector, the chimney connector should be as high as possible while still maintaining the 18" (457mm) minimum distance from the horizontal connector to the ceiling.

NOTE: Residential Close Clearance and Alcove installations require a listed double wall connector from the stove collar to the ceiling level.

The diagrams below illustrate one way to install your unit into a standard ceiling or with a horizontal connector. Check with your dealer or installer for information on other options available to you.



Standard Ceiling Installation



Horizontal Installation

RECOMMENDED HEIGHTS FOR WOODSTOVE FLUE

Simple rules on draft (refer to Table 1).

1) At sea level minimum height is 12' straight.

2) Add the following vertical height to compensate for:
45 deg. elbow = 1 ft.
90 deg. elbow = 2 ft.
"T" = 3 ft.
Each foot of horizontal run = 2 ft.

3) Add 4% overall for each 1000' above sea level.

Example: a)
1-1/2 ft. of horizontal run = 3 ft.
one "T" = 3 ft.
Total Addition (at sea level) = 6 ft.

Example: b)
One 90 deg. elbow = 2 ft.
2 ft. of horizontal run = 4 ft.
one "T" = 3 ft.
Total Addition (at sea level) = 9 ft.

	Recommended Flue Height		
Elevation	**Example a)**	**Example b)**
0'	18'	21'
1000'	18.72'	21.84'
2000'	19.44'	22.68'
5000'	21.60'	25.20'
8000'	23.76'	27.72'

MINIMUM RECOMMENDED FLUE HEIGHTS IN FEET (Measured from the top of the unit)				
ELEVATION (FT) ABOVE SEA LEVEL	**NUMBER OF ELBOWS For listed double wall pipe.**			
	0	2 x 15°	2 x 30°	2 x 45°
0-1000	12.0	13.0	15.0	16.0
1000-2000	12.5	13.5	15.5	16.5
2000-3000	13.0	14.0	16.0	17.0
3000-4000	13.5	14.5	17.0	18.0
4000-5000	14.0	15.0	17.5	18.5
5000-6000	14.5	15.5	18.0	19.0
6000-7000	15.0	16.0	18.5	20.0
7000-8000	15.5	16.5	19.0	20.5
8000-9000	16.0	17.0	20.0	21.0
9000-10000	16.5	17.5	20.5	22.0
NOTE: No more than one offsets (two elbows) allowed. Two 45° elbows equal one 90° elbow.				

Table 1

MOBILE HOME INSTALLATION

For Canadian Installations: see Outside Air Kit Blanking Plate - Part # 042-909
There are further requirements when installing this unit into a mobile home in Canada Only.

Once you have properly marked the position of your unit and the floor protection as outlined in the Residential Installation items #1 through #8, a supply of fresh air has to be supplied to your unit.

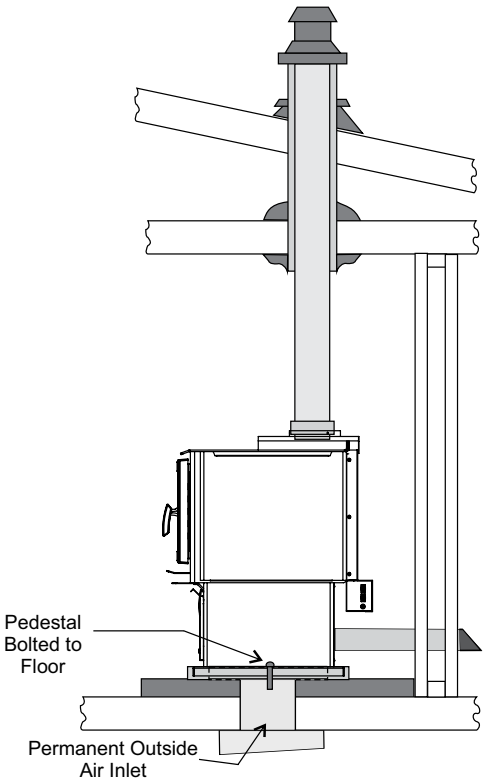
See Optional Outside Air Kit instructions in this manual.

Place your unit in position and secure it to the floor using two lag bolts 3/8" (10mm) x 3-1/2" (89mm) through the two holes inside the pedestal base. It is important to maintain the structural integrity of the Mobile Home floor, walls and roof when installing your unit.

For Mobile Home units installed in the U.S. the unit must be grounded using a #8 ground wire with approved termination and star washer.

CAUTION: At no time use unlabelled parts, or substitute parts made for another chimney system.

Install as per chimney manufacturer's installation instructions.



WARNING: Operate only with door fully closed - open feed door to feed fire only.

In addition to standard installation instructions the following requirements are mandatory for installation in a mobile home.

1. The stove must be permanently bolted to the floor of the Mobile Home using the floor screws provided.
2. The stove must have a permanent outside air source for combustion.
3. The stove must be electrically grounded to the steel chassis of the Mobile Home.
4. A listed double-wall connector chimney system, roof thimble, spark arrestor and roof flashing kit suitable for use in Mobile Homes must be used.
5. If the chimney exits the Mobile Home at a location other than through the roof, and exits at a point 7ft. (2130mm) or less above the ground level on which the Mobile Home is positioned a guard or method of enclosing the chimney shall be fitted at the point of exit for a height up to 7ft. (2130mm).
6. The chimney shall be attached directly to the room heater and shall extend at least 3 ft. (914mm) above the part of the roof through which it passes. The top of the chimney should project at least 2ft. (610mm) above the highest elevation of any part of the Mobile Home within 10 ft. (3048mm) of the chimney.
7. The chimney system shall comply with Local Requirements.
8. Any openings in a chimney guard where required must not permit the entrance of 3/4" (19mm) diameter rod.
9. **CAUTION: THE STRUCTURAL INTEGRITY OF THE MOBILE HOME ROOF, FLOOR, WALLS AND CEILING MUST BE MAINTAINED.**
10. Check any other local building code as other local codes may apply.
11. **WARNING: DO NOT INSTALL IN A SLEEPING ROOM OF A MOBILE HOME.**
12. Use silicone to create an effective vapour barrier at the location where the chimney or other component penetrates to the exterior of the structure.

1. Identify the position of the outside air damper by the orientation of the metal handle that rests outside the galvanized pipe. The metal handle and the damper disc are in line with each other. This means that if the metal handle is in a horizontal position, the damper is flat and fully open.
2. Open the damper fully whenever you start a fire. This will allow the outside air to be drawn in the pedestal base eliminating any potential smoke escaping the stove and entering the room. (Negative air pressure)

OPTIONAL OUTSIDE AIR KIT

The Outside Air Kit is an option for Freestanding Stoves. Outside air for combustion can be brought in either through the bottom of the pedestal or through the rear plate of the pedestal.

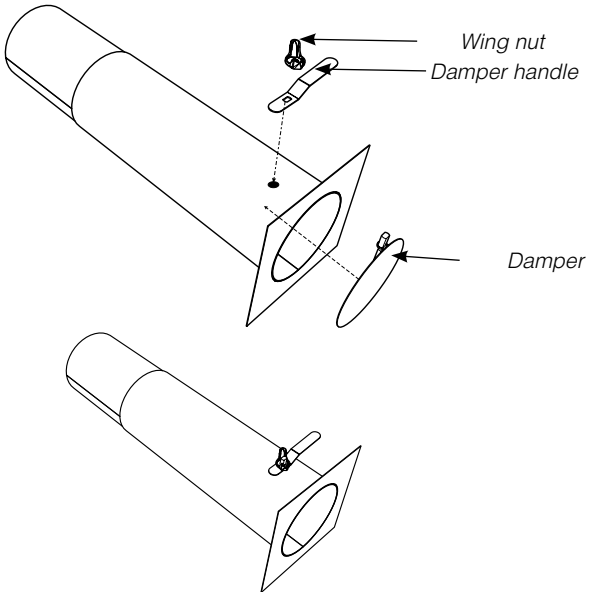
Damper Installation

NOTE: The damper cannot be installed if attaching outside air to the bottom of the appliance.

Supplied damper allows the combustion air to be closed off when unit is not in operation.

Install the damper within the round pipe in an easily accessible location.

1. Drill a 5/16" hole in the desired location.
2. Insert damper with threaded section out.
3. Install damper handle and secure with wing nut.

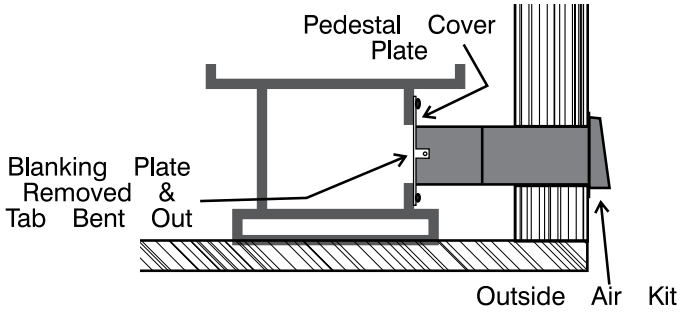


Completed Install

Outside Air Through Pedestal Rear

Remove the blanking plate from the rear of the pedestal and bend the two tabs out 90 degrees. Pipe fresh air into the pedestal area by using a minimum 4" metallic duct pipe with a mesh grill at the outside termination.

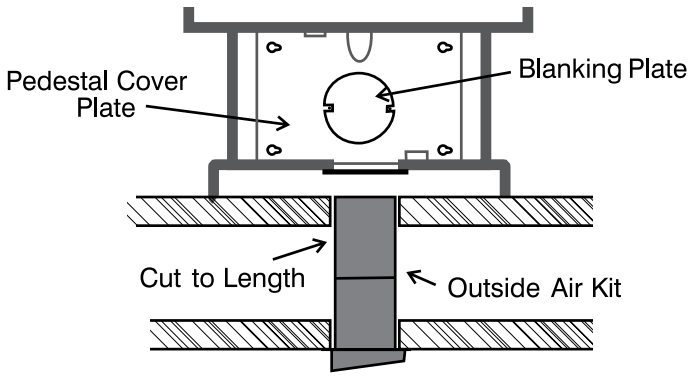
Fasten the pipe to the cover plate using the tabs and 2 screws.



Side View

Outside Air Through Pedestal Bottom

Mark the position of your unit as outlined in the "General Information" and "Clearances to Combustibles" section of the manual. Pipe fresh air into the pedestal area by using a minimum 4" duct pipe with a mesh grill at the outside termination.



Rear View

LISTED COMPONENTS FOR MOBILE HOME INSTALLATION

The Regency F3500B Freestanding pedestal units are approved for installation in a Mobile Home if one of the following pipe systems is used.

U.S. Installation*

METALBESTOS SSII

Qty.	Part #	Description
1	6DS-VK	Connector Kit
1	6TMH	Shield/Support
1	6TAF-6	Flashing
1	6T-36	Chimney Length
1	6T-18	Chimney Length
1	6T-CT	Rain Cap

PRO-JET 3103

Qty.	Part #	Description
1	PV06-TK	Connector
1	CSB	Shield/Support
1	RRS	Radiation Shield
1	LFR03	Flashing
1	SL3	Chimney Length
1	SL1	Chimney Length
1	RCSA	Rain Cap

SECURITY ASHT

Qty.	Part #	Description
1	DL42A-6	Connector Kit
1	6SS	Shield/Support
1	6FAMH	Flashing
1	6L3	Chimney Length
1	6L1	Chimney Length
1	CPE	Rain Cap

SECURITY S2100

Qty.	Part #	Description
1	DL42A-6	Connector Kit
1	6XSF	Support
1	6XFA	Flashing
1	6XL3	Chimney Length
1	6XL18	Chimney Length
1	6XCPE	Rain Cap

METAL-FAB TEMP/GUARD 2100

Qty.	Part #	Description
1	6DWBK	Connector
1	6TGRS	Roof Support
1	6TGG36	Chimney Length
1	6TGG12	Chimney Length
1	6TGF	Flashing
1	6TGC	Rain Cap

AMERI-TEC HS

Qty.	Part #	Description
1	6DCC	Connector
1	6HSRS-12	Roof Support (6PLRS-12-BK)
1	6F	Flashing
1	6HS-36	Chimney Length
1	6HS-18	Chimney Length
1	6HS-RCS	Rain Cap (6PL-MPC)

SIMPSON DURA-PLUS

Qty.	Part #	Description
1	6DVL8693	Connector Kit
1	6DP-MH9096	Mobile Home Kit

ICC EXCEL 2100

Qty.	Part #	Description
1	6CL48	48" Chimney length (also in 12", 18", 24" lengths.
1	6RC	Rain Cap
1	6RCS	Spark Screen (for rain cap)
1	6RDS/SQS	Round/Square support box
1	6VF	Flashing
1	6UBA	"Ultrablack" Close Clearance Connector

Canadian Installations*

SECURITY S2100

ICC EXCEL 2100

SELKIRK SENTINAL CF

*The use of alternate pitch flashings, support box extensions, additional chimney lengths, and additional chimney bracing, may be used on each of the previously listed systems. These parts though must be from the same system as listed, and must be a similar and/or complimentary part.

CAUTION: At no time use unlabelled parts, or substitute parts made for another chimney system.

Install as per chimney manufacturer's installation instructions.

STAINLESS STEEL SMOKE DEFLECTOR INSTALLATION/REPLACEMENT

1. The stainless smoke deflector is located in the upper front area of the firebox (see diagram below). The deflector is held in place with 2 x 7/16" hex head bolts. Prior to the first fire, ensure deflector is seated properly and secured with 2 hand tightened bolts.

2. To replace the deflector, loosen off both 7/16" bolts and slide deflector upward and out. Install new deflector and hand tighten 7/16" hex head bolts. Ensure positive location of the deflector prior to hand tightening.
WARNING: Operation of the unit without proper installation of smoke deflector will void warranty.

3. Ensure deflector is seated so bolts are situated at the top of the opening before tightening. Hand tighten bolts only.

3. Correct Install: Ensure return edge of smoke deflector is seated within the backside of the glass wash.

3. Incorrect Install: Return edge of smoke deflector seated under the glass wash.

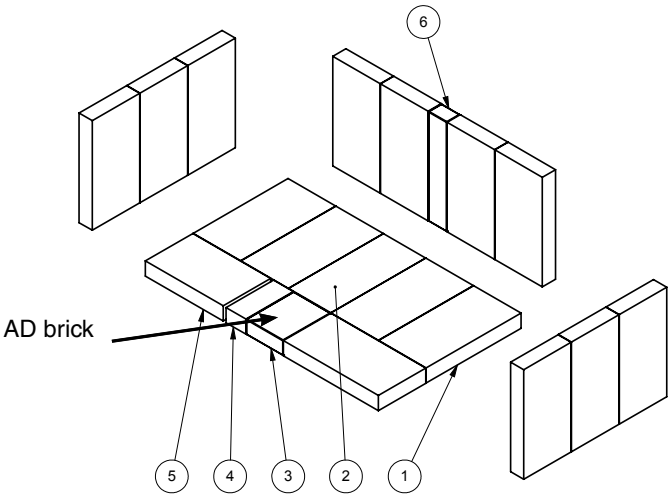
BRICK INSTALLATION

Firebrick is included to extend the life of your stove and radiate heat more evenly. Install all firebricks per the diagram below and place in their correct positions. Do not use a grate.

1. Remove box of firebricks from inside unit.

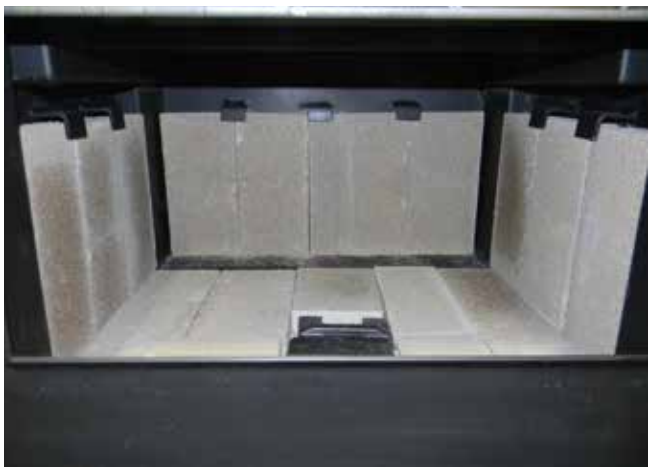
2. Remove LyTherm sheet from mailer tube and install on base of firebox as shown below.

3. Order of firebrick install:
- a) Rear Firebrick
- b) Firebox floor - install brick over LyTherm sheet
- c) Right and left side Firebricks



Fire bricks	
#	Size
1	4-1/2" x 9"
2	4" x 9"
3	3-1/2" x 4-1/2"
4	1-3/4" x 4-1/2"
5	4-1/2" x 7-5/8"
6	1-3/4"" x 9"

NOTE: The "AD" brick covers the Ash Dump hole that is used when the Ash Drawer Kit is installed.

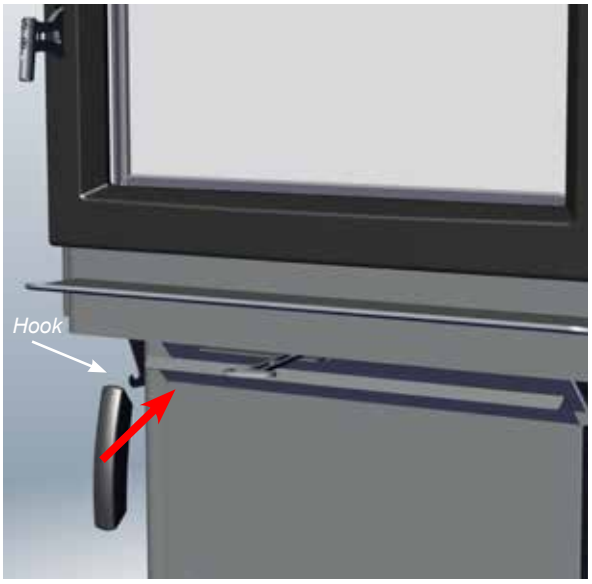


Final Install

REMOVABLE DOOR HANDLE

The F3500 has a removable door handle that can be stored when not in use.

The cool to touch door handle is designed to be inserted from the bottom up and slide off when not held in place. Once in position, the door can be opened. After use, store the door handle on the storage hook located on the left side of the faceplate



WARNING: FAILURE TO USE REMOVABLE HANDLE AS PER INSTRUCTIONS MAY CAUSE SERIOUS BURNS.

FAN INSTALLATION

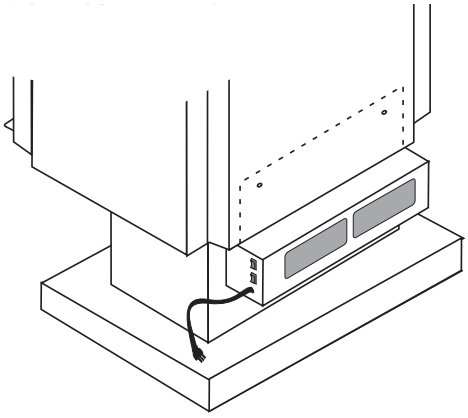
Fan assembly for use only with the room heater marked to indicate such use.

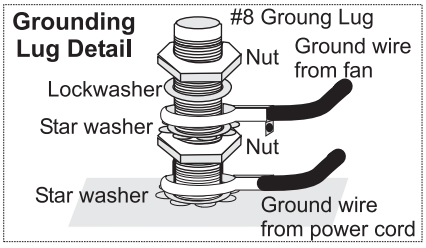
FAN INSTALLATION (120V FAN)

1. Remove the two screws from the top of the fan housing.
2. Slide the fan up into the rear heat shield.
3. After aligning holes, secure the fan to the rear heat shield using the two screws removed earlier.

Note: The connection cord should not be in contact with any hot surfaces.

WARNING: FAN ASSEMBLY MUST BE DISCONNECTED FROM THE SOURCE OF ELECTRICAL SUPPLY BEFORE ATTEMPTING THE INSTALLATION.





FAN OPERATION

AUTOMATIC

To operate the fan automatically, push the bottom switch on the side of the fan housing to "AUTO" and the top switch to either "HIGH" or "LOW" for fan speed.

This will allow the fan to turn on as the stove has come up to operating temperature. It will also shut the fan system off after the fire has gone out and the unit cooled to below a useful heat output range.

If the fan cycles on and off continuously the thermo switch sensor is not making contact with the stove body. Remove the fan, bend the bracket closer to the stove and re-install the fan.

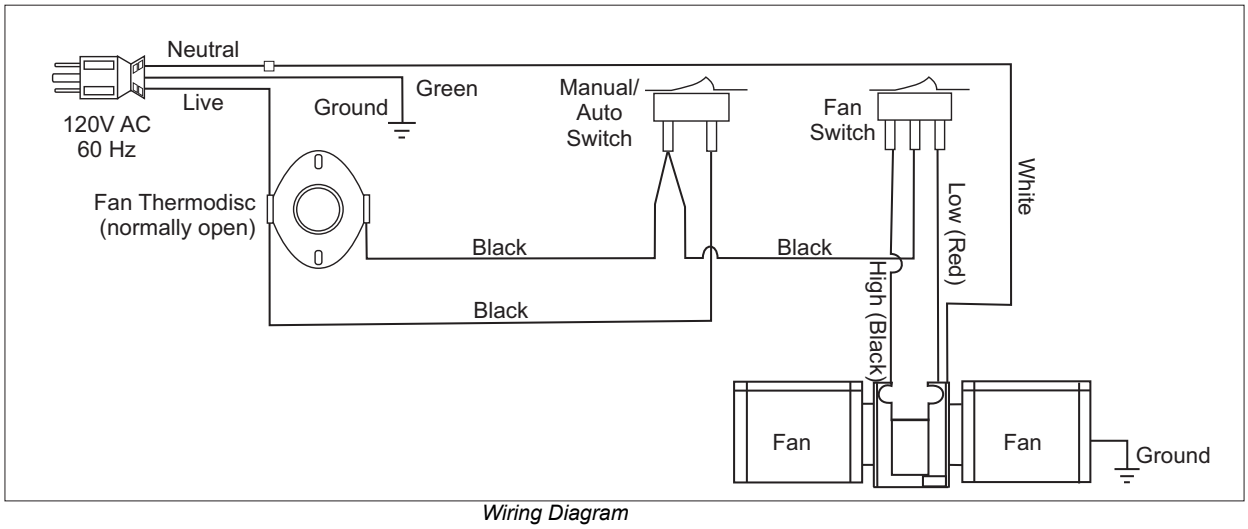
MANUAL

To manually operate the fan system push the bottom switch to "MAN" and the top switch to either "HIGH" or "LOW". This will bypass the sensing device and allow full control of the fan.

Switching from "AUTO" to "MAN" or "HIGH" to "LOW" may be done anytime.

WARNING: Electrical Grounding Instructions
This appliance is equipped with a three pronged (grounding) plug for your protection against shock hazard and should be plugged directly into a properly grounded three-prong receptacle. Do not cut or remove the grounding prong from this plug.

CAUTION: Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.



Wiring Diagram

SEASONED FIREWOOD

Whether you burn wood in a fireplace, stove or insert, good quality firewood is the key to convenience, efficiency and safety. Wet wood and pieces that are not the right size and shape for your wood burner can be frustrating, burn inefficiently and deposit creosote that can fuel a dangerous chimney fire. Good planning, seasoning and storage of the firewood supply are essential to successful wood burning.

- Stack the wood in separate rows in an open location where the summer sun can warm it and breezes can carry away the moisture. Do not stack unseasoned wood tightly in an unvented storage area.
- Do not allow firewood to lie on the ground for more than a couple of days before stacking. Mould and rot can set in quickly.
- Stack the wood up off the ground on poles, lumber rails or pallets.
- The top of the pile can be covered to keep off rain, but do not cover the sides.

Softer woods like pine, spruce and poplar/aspen that is cut, split and stacked properly in the early spring maybe be ready for burning in the fall. Extremely hard woods like oak and maple, and large pieces of firewood, may take a minimum of a full year to dry enough. Drying may also take longer in damp climates

There are a few ways to tell if wood is dry enough to burn efficiently. Use as many indicators as possible to judge the dryness of the firewood your are considering. Here are ways to judge firewood moisture.

- Using a moisture meter, select the species of fuel and then penetrate the pins into a split piece. Ideal moisture and seasoned firewood should be less than 20% moisture content.
- Checks or cracks in the end grain can be an indication of dryness, but may not be a reliable indicator. Some wet wood has checks and some dry wood has no checks.
- The wood tends to darken from white or cream colour to grey or yellow as it dries.
- Two dry pieces banged together sound hollow; wet pieces sound solid and dull.
- Dry wood weighs much less than wet wood.
- Split a piece of wood. If the exposed surface feels damp, the wood is too wet to burn.

OPERATING INSTRUCTIONS

With your unit now correctly installed and safety inspected by your local authority, you are now ready to start a fire. Before establishing your first fire, it is important that you fully understand the operation of your Catalytic combustor and draft control.

WARNING
Fireplace Stoves equipped with doors should be operated only with doors fully closed. If doors are left partly open, gas and flame may be drawn out of the fireplace stove opening, creating risks from both fire and smoke.

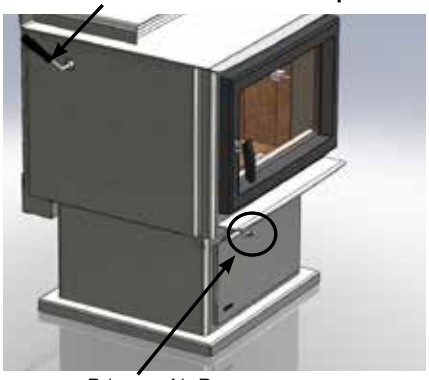
DRAFT CONTROL

Both the primary and air wash drafts are controlled by the control slide located on the front left side of the unit (when facing the unit). To increase your draft - slide to the left to open, and to decrease - slide to the right to close. The F3500 unit has a secondary draft system that continually allows combustion air to the induction ports at the top of the firebox, just in front of the catalytic combustor.

Draft is the force which moves air from the appliance up through the chimney. The amount of draft in your chimney depends on the length of the chimney, local geography, nearby obstructions and other factors. Too much draft may cause excessive temperatures in the appliance and may damage the catalytic combustor. Inadequate draft may cause back puffing into the room and plugging of the chimney or catalyst.

Catalyst Bypass Control

Back - Closed **Front - Open**



Primary Air Damper

Left - Open **Right - Closed**

WARNING: To build a fire in ignorance or to disregard the information contained in this section can cause serious permanent damage to the unit and void your warranty!

FIRST FIRE

When your installation is completed and inspected you are ready for your first fire.

THIS UNIT IS DESIGNED TO BURN SEASONED CORDWOOD ONLY. COAL, BRIQUETTES AND ALL OTHERS LISTED ON PAGE 2 ARE NOT APPROVED. SEASONED CORDWOOD SHOULD BE LESS THAN 20% MOISTURE CONTENT.

START UP AND OPERATING PROCEDURES:

1. For the first few days, the wood stove will give off an odour from the paint. This is to be expected as the high temperature paint becomes seasoned. Windows and/or doors should be left open to provide adequate ventilation while this temporary condition exists. Burning the wood stove at a very high temperature the first few times may damage the paint. During the first few fires, keep the combustion rate at a moderate level and avoid a large fire. Only after 5 or 6 such fires you can operate the wood stove at its maximum setting, and only after the metal has been warmed.
2. Do not place anything on the wood stove top during the curing process. This may result in damage to your paint finish.
3. When starting the fire, ensure the bypass is in the fully open position and air control is in the fully open position.
   To start a good and clean fire you will need approx. 4.5lb kindling and 6.5lb start up fuel, wood split slightly larger than kindling, approx. 2 inches thick.
   Start with few pieces of crumpled paper and half of the kindling, stacked in a manner that allows air flow on the firebrick hearth (Tee pee style or other). DO NOT USE A GRATE TO ELEVATE THE FIRE.
   Light crumpled newspaper and adjust the door to establish fire and for less smoke roll out. Keep the door in that position for approx. 4 minutes to establish a good fire. Once the door is closed, close the bypass.
4. Once most of the kindling has burned down, add the remaining of the kindling. Close the door soon after loading to keep the catalyst from cooling down.
5. When a good fire is established, add half of the start up fuel. Keep bigger pieces for the next load. Close the door right away.
6. While there are strong flames, add the remainder of the start up fuel more to the back of the firebox. Close the door right away after loading. **NOTE:** These steps are crucial to ensure proper charcoaling and coal bed prior to loading High, Med and Low fire loads.
7. Once a nice coal bed is established and there are still good sized flames, open the door and the bypass, and rake the coals to create a uniform charcoal bed. Load 6 pieces of 17" long cord wood, front to back, North/South orientation Once loaded, and strong flames are established, close the door and the bypass. Burn on high setting (air control to the far left when facing the unit) for at least 15 minutes.
   After 15 minutes, it should be a strong fire and you can adjust the air control to your desired position.
   After at least 20 minutes the fan can be set on high setting for a high and medium high fire and on low for medium and low fire.
   High Fire: Air control to far left.
   Low Fire: Air control to far right.
   Med Fire: Air control slightly left of low fire setting.
   For low and medium fire, adjust the air gradually from high to the desired position.
8. IMPORTANT: The temperature in the wood stove and the gases entering the combustor must reach between 500ºF - 700ºF for catalytic activity to start. From the start up of a cold wood stove, a medium to high firing rate must be maintained for 30 min. This ensures that the wood stove, catalyst and fuel are all stabilized at proper operating temperatures. Even though it is possible to have temperatures at 600ºF within minutes after a fire has been started, if the fire is allowed to die down immediately it may go out or the combustor may stop working. Once the combustor starts working, heat generated in it by burning the smoke will keep it working. During re-fueling and rekindling of the cool fire, or a fire that has burned down to the charcoal phase, operate the wood stove at a medium to high firing rate for about 10 minutes to ensure that the catalyst reaches operating temperatures.

   WARNING: Never build a roaring fire in a cold wood stove. Always warm your wood stove up slowly!
9. When re-fueling, always open bypass control, and primary air damper, load fuel, then wait for at least 10-15 minutes before closing the by-pass. Reason for the 10-15 min. is the fresh fuel and the opening of the door will cause the catalyst to drop in temperature as well as the moisture within the wood which is the first thing to be released. This will also minimize any smoking (spilling) back into the room.
10. During the first few days it may be more difficult to start the fire. As you dry out your firebrick and your masonry flue, your draft will increase.
11. For those units installed at higher elevations or into sub-standard masonry fireplaces, drafting problems may occur. Consult an experienced dealer or mason on methods of increasing your draft.
12. Some cracking and popping noises may be experienced during the heating up process. These noises will be minimal when your unit reaches temperature.
13. All fuel burning appliances consume oxygen during operation. It is important that you supply a source of fresh air to your unit while burning. A slightly opened window is sufficient for the purpose. If you also have another fireplace in your home, a downdraft may be created by your Regency wood stove causing a draft down your chimney. If this occurs, slightly open a window near your unit.

CAUTION: If the body of your wood stove, or any part of the chimney connector starts to glow, you are over firing. Stop loading fuel immediately and close the draft control until the glow has completely subsided.

How to Light and Maintain a Wood Stove Fire

14. Green or wet wood is not recommended for your unit. If you must add wet or green fuel, open the draft control fully until all moisture has been dispersed by the intense fire. Once all moisture has been removed, the draft control may be adjusted to maintain the fire.
15. If you have been burning your stove on a low draft, use caution when opening the door. After opening the damper, open the door a crack, and allow the fire to adjust before fully opening the door.
16. The controls of your unit or the air supply passages should not be altered to increase firing for any reason.
17. If you burn the unit too slowly or at a too low setting your unit will not be operating as efficiently as it can. An easy rule of thumb says that if your glass is clean, catalytic thermostat is active, then your flue is clean and your exhaust is clean. Burn the stove hot enough to keep your glass clean and catalytic combustor, you won't need to clean your flue as often.

HOT WHILE IN OPERATION. KEEP CHILDREN, CLOTHING AND FURNITURE AWAY. CONTACT MAY CAUSE SKIN BURNS.

NOTE: You can stir and level the coals before reloading to ensure proper charcoaling and a good start up of the load.

FAN OPERATION

Automatic
To operate the fan automatically, push the bottom switch on the side of the fan housing to "AUTO" and the top switch to either "HIGH" or "LOW" for fan speed.

This will allow the fan to turn on as the stove has come up to operating temperature. It will also shut the fan system off after the fire has gone out and the unit cooled to below a useful heat output range.

Route power cord to either left or right behind unit.

Manual
To manually operate the fan system push the bottom switch to "MAN" and the top switch to either "HIGH" or "LOW". This will bypass the sensing device and allow full control of the fan.

Switching from "AUTO" to "MAN" or "HIGH" to "LOW" may be done anytime.

ASH DISPOSAL

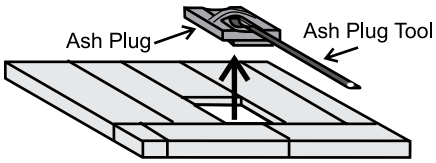
During constant use, ashes should be removed every few days. The Ash Drawer option features a convenient ash dump for easy removal of ash, refer to Modular Installation Options section.

Safety Precautions

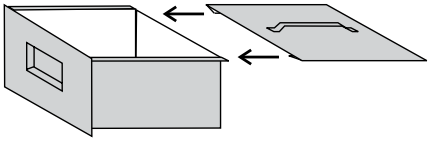
1. Do not allow ashes to build up to the loading doors! Only remove ashes when the fire has died down. Even then, expect to find a few hot embers.
2. Please take care to prevent the build-up of ash around the start-up air housing located inside the stove box, under the loading door lip.
3. Never start a fire if the ash plug and ash drawer are not in place. This will cause over firing which can cause excessive warping of the stove. Evidence of over firing can void the warranty on your stove.
4. The firebricks are brittle and can be damaged if the plug is replaced carelessly or pieces that are too large are forced through the hole.

Ash Drawer Operating Guideline

1. Only clean ashes out of the stove when the unit has cooled down. Remove the plug by lifting on the handle using the tool provided. The plug may still be warm, use caution. Push the ashes down the hole into the ash drawer, the large pieces can be left in the firebox and burned during the next fire or removed through the door opening.
2. Always leave 1/2 to 1 inch of ash in the bottom of the firebox. This helps in easier starting and a more uniform burn of your fire. Replace ash plug when ashes have been removed.



3. **Pedestal Units:**
   To remove the drawer, lift slightly and slide it out. When the drawer is completely out, slide the cover plate over the ash drawer and carry away.



CAUTION: HOT WHILE IN OPERATION. KEEP CHILDREN, CLOTHING AND FURNITURE AWAY. CONTACT MAY CAUSE SKIN BURNS.

4. When emptying the ash drawer, make sure the ashes are cold. Ashes should be placed in a metal container with a tight fitting lid. The closed container of ashes should be placed on a non-combustible floor or on the ground, well away from all combustible materials, pending final disposal. If the ashes are disposed of by burial in soil or otherwise locally dispersed, they should be retained in the closed container until all cinders have thoroughly cooled. Other waste should not be placed in the ash container.
5. Before putting the ash drawer back into place, make sure the ash plug is back in place.

   Pedestal Units: make sure the cover lid is off.

SAFETY GUIDELINES AND WARNINGS

CAUTION: DO NOT USE CHEMICALS FOR FLUIDS TO START FIRE.

1. **CAUTION:** Never use gasoline, gasoline type lantern fuels, kerosene, charcoal lighter fuel, or similar liquids to start or 'freshen up' a fire in your heater. Keep all such liquids well away from the heater while it is in use.
2. Keep the door closed during operation and maintain all seals in good condition.
3. Do not burn any quantities of paper, garbage, and never burn flammable fluids such as gasoline, naptha or engine oil in your stove.
4. If you have smoke detectors, prevent smoke spillage as this may set off a false alarm.
5. Do not overfire heater. If the chimney connector, flue baffle or the stove top begin to glow, you are over firing. Stop adding fuel and close the draft control. Over firing can cause extensive damage to your stove including warping and premature steel corrosion. Over firing will void your warranty.
6. Do not permit creosote or soot build-up in the chimney system. Check and clean chimney at regular intervals. Failure to do so can result in a serious chimney fire.
7. Your Regency stove can be very hot. You may be seriously burned if you touch the stove while it is operating, keep children, clothing and furniture away. Warn children of the burn hazard.
8. The stove consumes air while operating, provide adequate ventilation with an air duct or open a window while the stove is in use.
9. Do not connect this unit to a chimney flue serving another appliance.
10. Do not use grates or andirons or other methods for supporting fuel. Burn directly on the bricks.
11. Open the draft control fully for 10 to 15 seconds prior to slowly opening the door when refuelling the fire.
12. Do not connect your unit to any air distribution duct.
13. This heater is designed to burn natural wood only. Higher efficiencies and lower emissions generally result when burning air dried seasoned hardwoods, as compared to softwoods or to green or freshly cut hardwoods.

DO NOT BURN:

- Treated wood
- Coal
- Garbage
- Cardboard
- Solvents
- Colored Paper
- Trash
- Salt drift wood
- Cut lumber, plywood, mill ends.

Burning treated wood, garbage, solvents, colored paper or trash may result in release of toxic fumes and may poison or render ineffective the catalytic combustor. Burning coal, cardboard, or loose paper can produce soot, or large flakes of char or fly ash that can coat the combustor, causing smoke spillage into the room, and rendering the combustor ineffective.

14. Do not store any fuel closer than 2 feet from your unit. Do not place wood, paper, furniture, drapes or other combustibles near the appliance.

15. WARNING: Do not operate without either the Ash Plug properly seated or the Ash Dump Plates screwed in place, excessive temperatures will result.

16. CAUTION: Do not operate with cracked/ broken, plugged, or glazing catalyst.

IMPORTANT : It is against federal regulation to operate this wood heater in a manner inconsistent with operating instructions in this manual, or if the catalytic element is deactivated or removed.

CAUTION: DO NOT BURN GARBAGE OR FLAMMABLE LIQUIDS SUCH AS GASOLINE, NAPTHA OR ENGINE OIL. SOME FUELS COULD GENERATE CARBON MONOXIDE AND ARE VERY DANGEROUS.

CAUTION: DO NOT CONNECT TO, OR USE IN CONJUNCTION WITH ANY AIR DISTRIBUTION DUCT WORK UNLESS SPECIFICALLY APPROVED FOR SUCH INSTALLATION.

	Troubleshooting Guide	
PROBLEM	**POSSIBLE CAUSE**	**SOLUTION**
Crumbling Substrate	Extreme Thermal Shock Refueling with Wet Wood High Draft	Bypass combustor when the stove is running Use seasoned, dried wood. Do not exceed .06" of water draft. Install a manual damper and draft gauge or a barometric damper.
Fly-Ash Build-up Fly-Ash Masking Fly-ash Plugging	Combustor has not maintained light-off temperature. Combustor has not maintained light-off temperature. Burning materials that produce a lot of char and fly-ash. Closing the bypass too soon	Brush cold combustor with a soft bristled brush or vacuum lightly. Brush cold combustor with a soft bristled brush or vacuum lightly. Do not burn cardboard, gift wrap or garbage. Follow instructions for proper light-off.
Thermal Cracking	Uneven temperatures, flame impingement and heat spikes.	If cracking causes large pieces to fall out, replace combustor.
Mechanical Cracks	Combustor mishandled or abused. Distortion of combustor holder.	Handle combustor with care. Replace if necessary. Replace combustor is large pieces are missing, replace any warped stove parts as well.
Plugging (Creosote)	Burning wet, pitchy woods or burning large loads of small diameter wood with the combustor in the operating position without light-off ever occurring.	Burn dried seasoned wood. Make sure combustor has light-off before closing the bypass damper. It may be possible to burn off the soot or creosote accumulation by putting the combustor in a partially open and partially closed position after a hot fire has been started.
Masking (Soot)	Combustor has not maintained a light-off. Burning coal will cause a sulfur-based compound to coat the catalyst.	Place combustor in a partially open and partially position after a hot fire has been started to burn off the soot accumulation. Revert to burning wood and fire the combustor to elevated temperatures for one hour.

MAINTENANCE

It is very important to carefully maintain your fireplace stove, including burning seasoned wood and maintaining a clean stove and chimney system. Have the chimney cleaned before the burning season and as necessary during the season, as creosote deposits may build up rapidly. Moving parts of your stove require no lubrication.

THERMOMETER

The catalyst thermometer is only a indication of the flue gas temperature as they pass through the catalyst. The thermostat probe that is inserted into the opening, must be cleaned at least once a year. Use 220 sand paper to clean probe.

CREOSOTE

When wood is burned slowly, it produces tar and other organic vapours combine with moisture to form creosote. The creosote vapours 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 can result in an extremely hot fire.

The chimney connector and chimney should be inspected at least once every two months during the heating season to determine if creosote build up has occurred. If creosote has accumulated it should be removed to reduce the risk of chimney fire.

CAUTION: Things to remember in case of a chimney fire:

1. Close all draft and damper controls.

2. CALL THE FIRE DEPARTMENT.

Ways to Prevent and Keep Unit Free of Creosote

1) Burn stove with the draft control wide open for about 10-15 minutes every morning during burning season.

2) Burn stove with draft control wide open for about 10 - 15 minutes every time you apply fresh wood. This allows the wood to achieve the charcoal stage faster and burns up any unburned gas vapours which might otherwise be deposited within the system.

3) **Only burn seasoned wood!** Avoid burning wet or green wood. Seasoned wood has been dried at least one year.

4) A small hot fire is preferable to a large smouldering one that can deposit creosote within the system.

5) The chimney and chimney connector should be inspected at least once every two months during the heating season to determine is a creosote buildup has occurred.

6) **Have chimney system and unit cleaned by competent chimney sweeps twice a year during the first year of use and at least once a year thereafter or when a significant layer of creosote has accumulated (3mm/1/8" or more) it should be removed to reduce the risk of a chimney fire.**

DOOR GASKET

If the door gasket requires replacement 5/8" diameter material must be used. Regency uses a gasket rope 5/8" Medium Density (Part #846-530). A proper high temperature gasket adhesive is required. See your Regency Dealer.
The door catch may require adjustment as the door gasket compresses after a few fires. The door latch compression may require adjustment to renew seal. Removal of a shim, (see section in this manual), will allow the latch to be moved closer to the door frame, causing a tighter seal.

GLASS MAINTENANCE

Your Regency stove is supplied with 5mm Neoceram ceramic glass (Part #940-416/P) that will withstand the highest heat that your unit will produce. In the event that you break your glass by impact, purchase your replacement from an authorized Regency dealer only, and follow our step-by-step instructions for replacement (refer to Glass Replacement section).

Allow the stove to cool down before cleaning the glass. Cleaning the glass will prevent build up of carbon and allow full view of the fire.
WARNING: Do not clean the glass when it is hot.
WARNING: Do not use abrasive cleaners, a damp cloth and glass cleaner is effective.

WOOD STORAGE

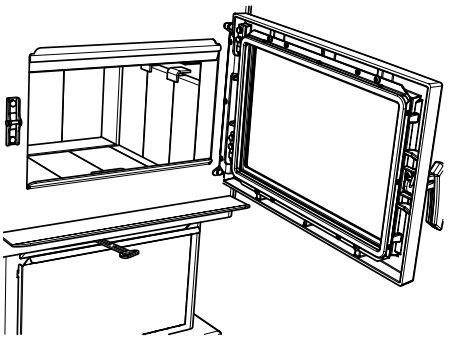
Store wood under cover, such as in a shed, or covered with a tarp, plastic, tar paper, sheets of scrap plywood, etc., as uncovered wood can absorb water from rain or snow, delaying the seasoning process.

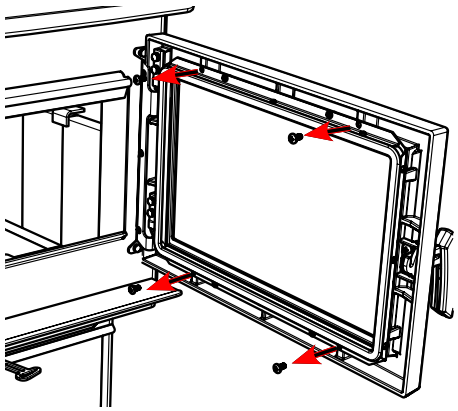
GLASS REPLACEMENT

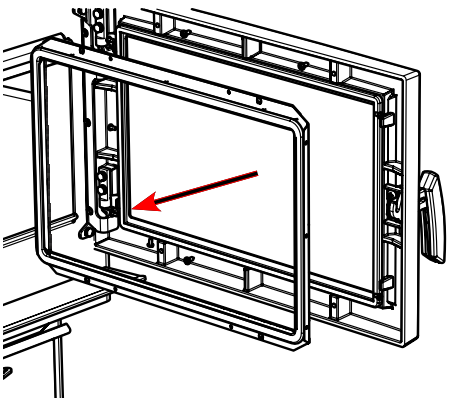
Allow the stove to cool before removing or replacing glass. Remove the door from the stove and remove the glass retainer. To avoid injury use caution when removing broken glass. Wear safety gloves. When placing the replacement glass in the door, make sure that the glass gasketing will properly seal your unit. Replace the retainer, it should rest on the gasket not the glass, and tighten securely with a glass clips and screws. Do not wrench down on the glass as this may cause breakage.

Do not use substitute materials. If your glass does break, do not use your unit until it has been replaced.

WARNING: Do not abuse the door by striking or slamming shut. Cracked glass can cause the heater to overfire.







CATALYTIC COMBUSTOR

ACHIEVING AND MAINTAINING CATALYST LIGHT-OFF:

The temperature in the stove and the gases entering the combustor must be raised to between 500F to 700F for catalytic activity to be initiated. During the start up of a cold stove a medium to high firing rate must be maintained for about 30 minutes. This ensures that the stove, catalyst and fuel are all stabilized at proper operating temperatures. Even though it is possible to have temperatures at 600F within minutes after a fire has been started, if the fire is allowed to die down immediately it may go out or the combustor may stop working. Once the combustor starts working, heat generated in it by burning the smoke will keep it working. During re-fueling and rekindling of the cool fire, or a fire that has burned down to the charcoal phase, operate the stove at a medium to high firing rate for about 10 minutes to ensure that he catalyst reaches operating temperatures.

CATALYST MONITORING: It is important to periodically monitor the operation of the catalytic combustor to ensure that it is functioning properly and to determine when it needs to be replaced. A non-functioning combustor will result in a loss of heating efficiency, and an increase in creosote and emissions. Following is a list of items that should be checked on a periodic basis.

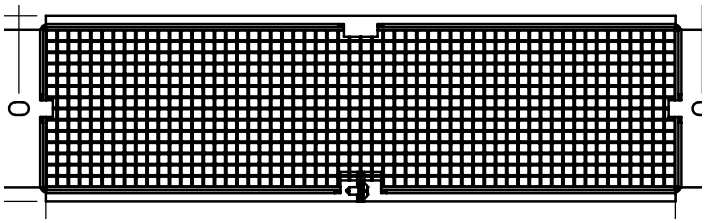
- Combustors should be visually inspected at least three times during the heating season to determine if physical degradation has occurred. Actual removal of the combustor is not recommended unless more detailed inspection is warranted because of decreased performance. If any of these conditions exist, refer to Catalyst trouble shooting section of this owner's manual.
- A good combustor is designed to withstand approximately 12,000 hours of continuous use. This will translate into five to ten years of use, depending on the length of your heating season and how often you use your stove. Proper maintenance will increase the combustor's effectiveness and prevent many problems. Inspect your combustor before each heating season, and during the season if your stove's performance seems to change.
- This catalytic heater is equipped with a temperature probe to monitor catalyst operation. Properly functioning combustors typically maintain temperatures in excess of 500F and often reach temperatures in excess of 1000F. If catalyst temperatures are not in within, refer to Catalyst trouble shooting section of this manual.
- You can get an indication of whether the catalyst is working by comparing the amount of smoke leaving the chimney when the smoke is going through the combustor and catalyst light – off has been achieved, to the amount of smoke leaving the chimney when the smoke is not routed (by-pass open) through the combustor.

Step 1: Light the stove in accordance with instructions within this manual.
Step 2: With smoke routed through the catalyst (by-pass closed) go outside and observe the emissions leaving the chimney.
Step 3: Engage the bypass mechanism and move to by-pass open position. And again observe the emission leaving the chimney. Significantly more smoke should be seen when the smoke is not routed through the combustor (by-pass open). Be careful not to confuse smoke with steam.

ACHIEVING PROPER DRAFT: Draft is the force which moves air from the appliance up through the chimney. The amount of draft in your chimney depends on the length of the chimney, local geography, nearby obstructions and other factors. Too much draft may cause excessive temperatures in the appliance and may damage the catalytic combustor. Inadequate draft may cause back puffing into the room and plugging of the chimney or catalyst.

CATALYTIC COMBUSTOR CLEANING:

Method #1
A vacuum cleaner may be used, but **never use high pressured air** to blow the cells free of any build-up. This can damage the cell walls. Any cell blockage can be removed with the use of a pipe cleaner or a cotton swab as well.
Method #2
Should the combustor's cells become covered with fly-ash, use a paint-brush or soft-bristled brush and dust the combustor gently. Never use anything abrasive to clean the combustor.
Method #3
Normally the catalytic combustor requires little or no maintenance, it generates such high temperatures and therefore is basically self-cleaning. However, should the combustor become covered with soot or creosote, it is possible to burn the accumulation off by opening the bypass and building a hot fire. Once the hot fire is created, close the bypass halfway and burn for 30 to 60 minutes with the bypass left in this position. **Never use cleaning solvents to clean it.** Check and clean the combustor, if necessary, before each burning season and inspect the flue system for any signs of creosote buildup. A clean flue helps prevent chimney flue fires.



F3500 Flameguard & Catalyst

COMBUSTOR ASSEMBLY REMOVAL/REPLACEMENT

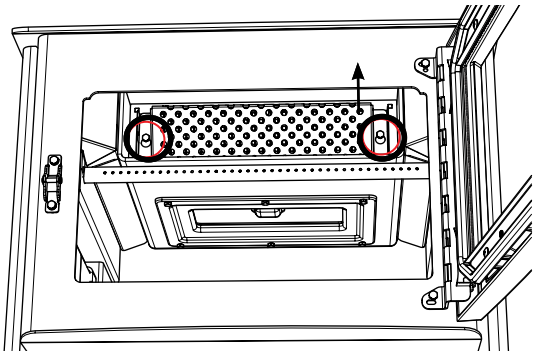
The catalytic thermometer on top of the stove should read in the active zone after the stove has been in operation for several hours. If the thermometer's indicator needle does not stay in the active zone, even with a hot fire, over a period of regular use, the catalyst may need to be cleaned. If this persists it may be necessary to replace it.

If the combustor must be examined or replaced, follow this procedure:

1. Allow the stove to burn out and cool down.

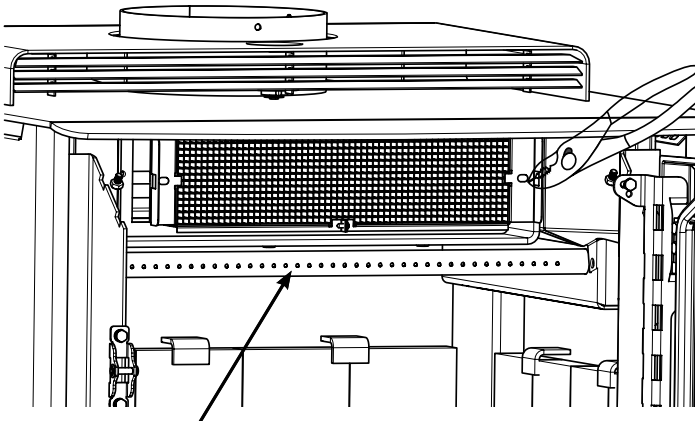
2. Remove stainless steel smoke deflector - See instructions in this manual.

3. Open the door and loosen the two 7/16" bolts -see locations below.



4. Lift flame shield slightly upwards in keyhole slot and pull it forward and down.

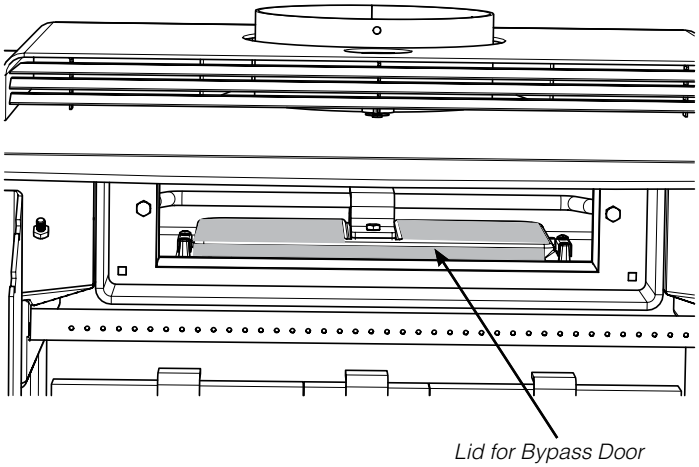
5. Use a pair of pliers and gently slide out the band at each end. The assembly will loosen enough that it can be pulled forward, lowered, and pulled out through the door.



F3500 Airtube

F3500 Airtube Replacement

NOTE: If also replacing the gasket in the bypass door (see next page), remove the lid of the bypass door while it is accessible and complete steps in Bypass Door Gasket Replacement.



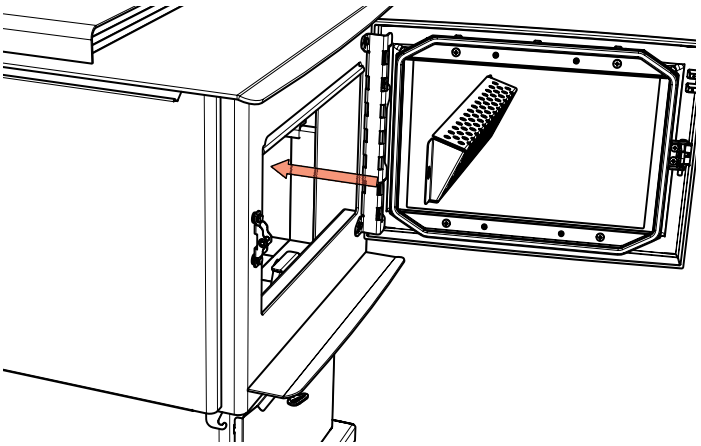
Lid for Bypass Door

TO REPLACE THE COMBUSTOR:

First clean the combustor area and the area around the by-pass,use a vacuum cleaner.

Lift the new combustor into position, with the stainless flanges on each end facing forward.
The combustor should slide easily into position, you may need to pinch down the top center with your finger to start, gently push as far to the back of the stove as possible.

Replace the flame shield in the orientation shown below.



Lift it into position, place the key slot opening over the bolt and push the flame shield down to seat. Tighten the bolt till its SNUG only, do not over tighten. The flame shield should rest at an angle (about 45 degrees) with the thin end at the bottom and the thick end near the top of the stove.

NOTE: Replacement combustors can be retrieved from Applied Ceramics or Contact your local Regency Dealer for details.

DO NOT OPERATE THE APPLIANCE IF COMBUSTOR BECOMES INACTIVE - DO NOT OPERATE WITHOUT COMBUSTOR.

BYPASS DOOR GASKET REPLACEMENT

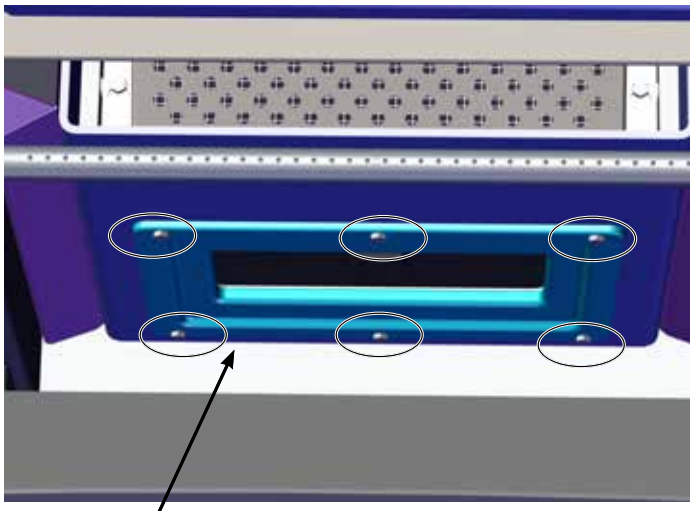
1. Allow the stove to burn out and cool down, until cool to touch.

2. Open stove door to access bypass door.

3. Loosen the 3 rear nuts, then remove 3 front nuts. Support the Bypass Door from the front /back and slide forward to remove Bypass Door Assembly.

Note: if any of the bolts become damaged, the bolt bracket assemblies may be replaced—see next page.

Important: Bypass door is very heavy (>18 lbs) - use caution when servicing.

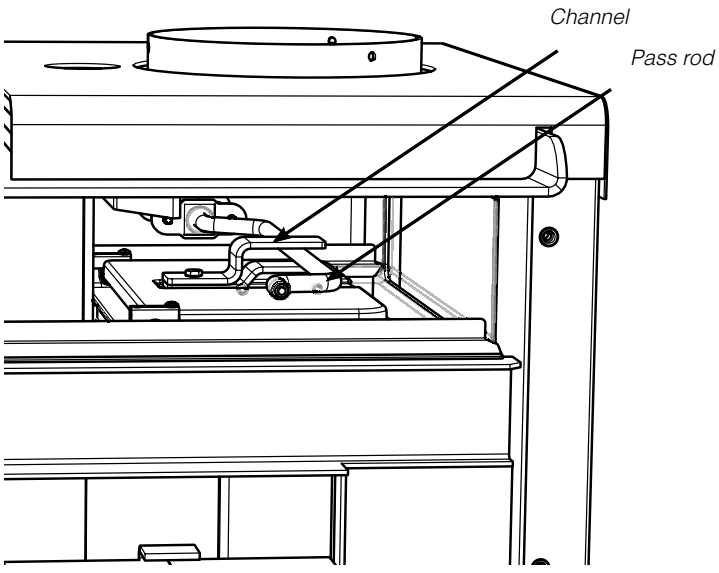


Loosen 3 rear nuts

4. Slide bypass door assembly forward, lower complete assembly with care. Lift lid on bypass door assembly to reveal gasket.

5. Remove old gaskets and replace with new ones.

6. Reverse steps to reinstall - ensure the pass rod is seated with the channel on the pass door.
(Unit viewed as transparent to facilitate view)



F3500 Damper Assembly Draft

BYPASS DOOR BOLT BRACKET ASSEMBLY REPLACEMENT

If any of the bolts used to secure the bypass door become damaged - the bypass door bolt bracket assembly can be replaced.

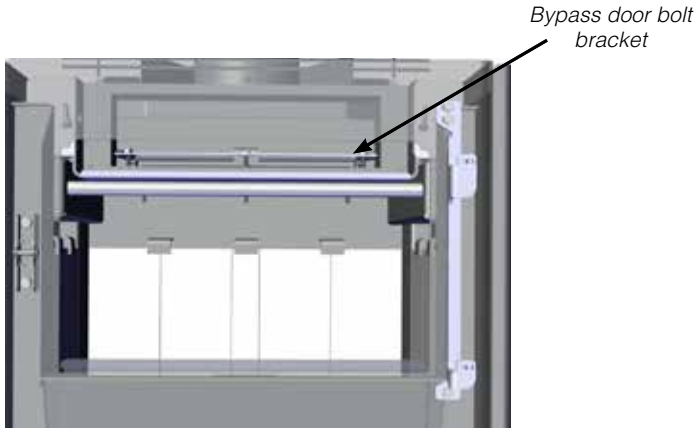
1. Allow the stove to burn out and cool down, until cool to touch.

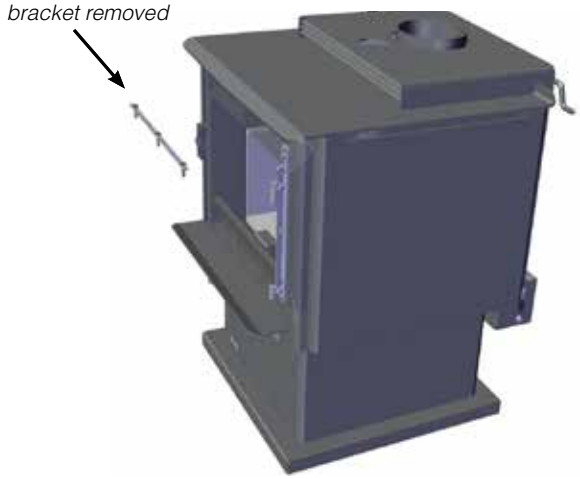
2. Remove bypass door before attempting to remove bolt bracket assembly—see detailed instructions on previous page.

3. Open stove door and remove stainless steel smoke deflector, flame shield and catalytic combustor to access bypass door—see detailed instructions in this manual.

4. Lift out (front or rear) bypass door bolt bracket assembly and replace with a new one.

Note: The rear nuts which are only loosened when removing the by pass door will need to be removed in order to remove the bolt bracket assembly.



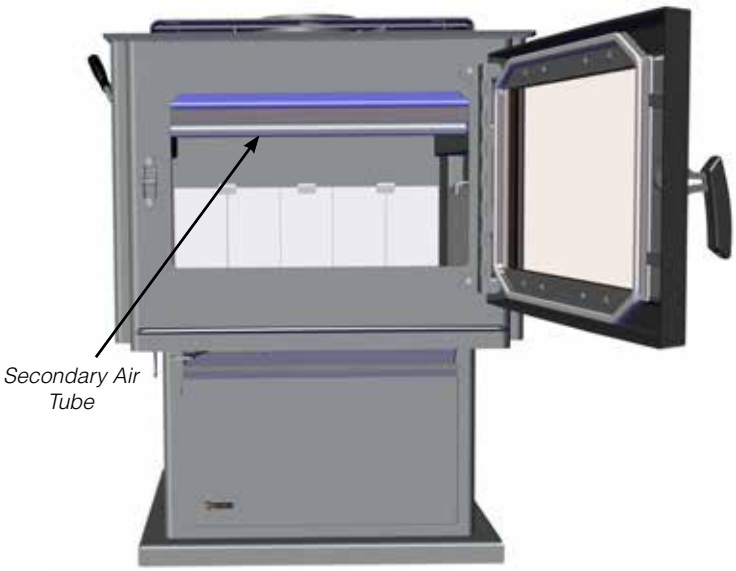


5. Reverse steps to reassemble stove.

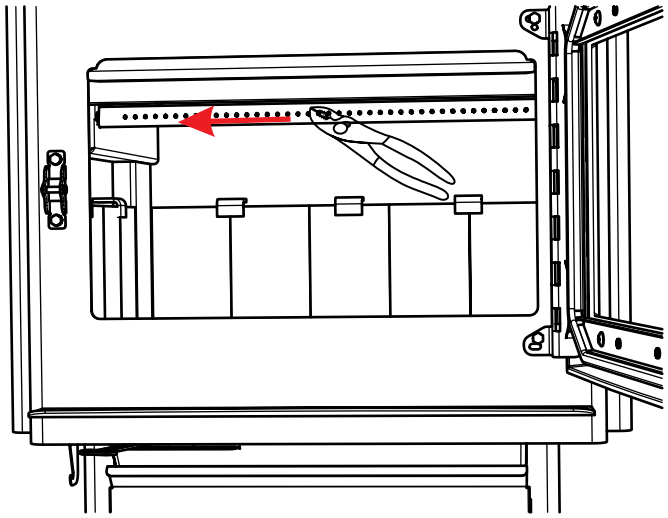
SECONDARY AIR TUBE REMOVAL/ INSTALLATION

1. Allow the stove to burn out and cool down, until cool to touch.

2. Open stove door to access secondary air tube.



3. Grasp secondary air tube firmly with vise grips, using a hammer tap vise grips from right to left until air tube is released from grip. Remove.

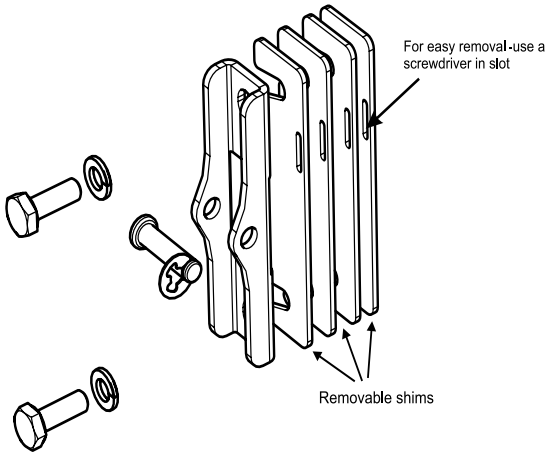


4. To reinstall or replace, first slide left side of tube into hole on left side air channel. Align tab on right side air channel with notch on right hand end of air tube. Firmly grip center of air tube with vise grips, use hammer to tap vise grips from left to right until the tube bottoms out into the air channel on right.

DOOR CATCH ADJUSTMENT

After a few fires, the door catch may require adjustment to renew a tight seal, as the door gasket will compress. Removal of a shim, shown in the diagram below, will allow the catch to be moved closer to the door frame, creating a tighter seal.

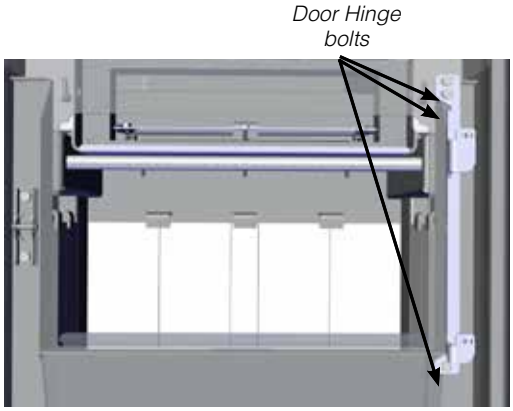
To remove a shim, loosen the 2 bolts to create clearance behind catch. Place a screwdriver in the slot of the shim and slide out. Retighten bolts.
Note: Keep the shims - they may be required in the future when the gasket is replaced.



DOOR HINGE ADJUSTMENT

If the door hinge ever requires adjustment, ensure that the bolt is put on hand tight and tightened a further 1/2 turn using a wrench.
Do not overthighten as this can damage the bolt or nutsert.

Note: Some models may only have 1 bolt at the top. This version shows 2 top bolts.



Annual Maintenance	
Completely clean out entire unit	Annually
Inspect air tube, Catalytic Combustor and bricks	Replace any damaged parts.
Adjust door catch assembly	If unable to obtain a tight seal on the door - replace door gasket seal. Readjust door catch after new gasket installed.
Inspect condition and seal of: Glass Gasket Door Gasket Bypass Door Gasket	Perform paper test - replace gasket if required
Paper Test	Test the seal on the loading door and bypass door with a paper bill. Place a paper bill in the gasket area of the door on a cold stove. Close the door. Try to remove the paper by pulling. The paper should not pull out easily; if it does, try adjusting the door latch (loading door only). If that doesn't solve the problem, replace the door gasket, bypass gasket, or both.
Check and lubricate door hinge + latch	Use only high temperature anti seize lube. (ie. never seize)
Check glass for cracks	Replace if required.
Clean blower motor	Disconnect power supply. Remove and clean blower. ***DO NOT LUBRICATE***
Inspect and clean chimney	Annual professional chimney cleaning recommended.
Thermostat Probe	The thermostat probe that is inserted into the opening, must be cleaned at least once a year. Use 220 sand paper to clean probe.

NOTE:

Chimney Cleaning

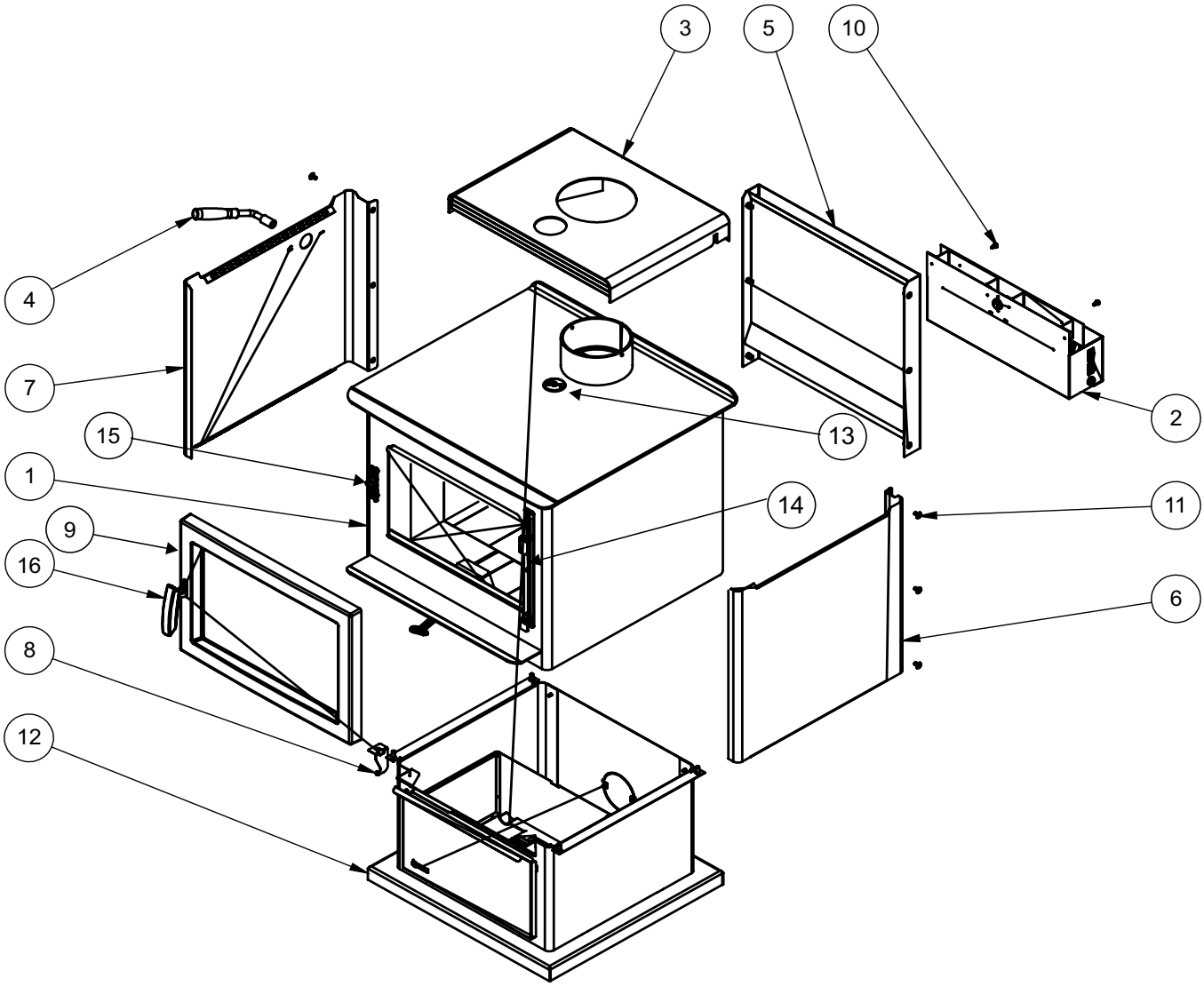
When cleaning the chimney system the catalyst should be removed so this can also be cleaned at the same time following the guide lines found in this manual. The bypass should be open so any creosote will fall onto the firebox floor when being cleaned and door closed. The monitor should also be removed when cleaning is being done to prevent damage to the monitor.
We highly recommend that the chimney cleaning be done by a professional as they will have the necessary tools such as a proper sized brush and special vacuum cleaner designed to deal with fine particles.

F3500 STOVE MAIN ASSEMBLY

	Part #	Description
2	846-515	Fan - free standing stove
3	042-912	Airmate - medium assembly
4	051-538	Removable arm assembly
5	*	Rear Heat Shield Assembly
6	042-029	Classic side heat shield - RH
7	042-028	Classic side heat shield - LH
	910-157/P	Replacement Motor
	910-138	Auto/Manual Switch
	910-140	Hi/Off/Lo switch
	910-142	Fan Thermodisc
	042-035	Flame shield and mixer
	815-557	Rear Deflector
	042-017	Gasket-Firebox Floor
	948-223	Regency Logo Plate

* Not a replacement part

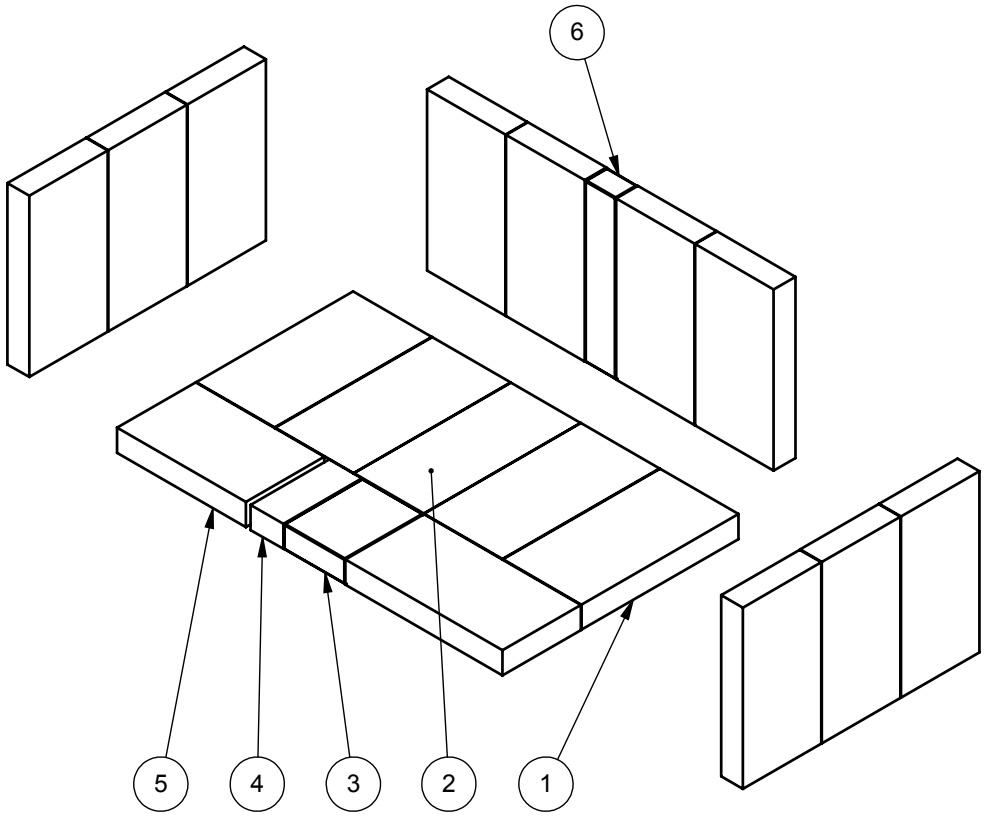
	Part #	Description
8	051-018	Handle holder
9	042-520	Cast door assembly
	051-530	Catalytic Combustor Assembly (not shown)
	033-953	Airtube 1" x 23" long
10	904-245	#10-16 x 1/2" SDS HEX HD
11	904-530	Screw 1/4-20 x 1/2 LG
12	042-532	Pedestal assembly
13	051-067	Thermometer
	936-074	Gasket Bypass Door
	042-007	Stainless Steel Smoke Deflector
14	042-509	Door Hinge Assembly
15	156-514	Door Catch assembly
16	156-241	Removable Cast Handle
	042-016	L/R stainless steel firebox filler
	051-085	Gasket Bypass Frame
	051-510	Bypass Frame 3 Bolt Assembly (each)
	919-552	Manual



F3500 STOVE BRICK LAYOUT

042-960 Brick Set Complete

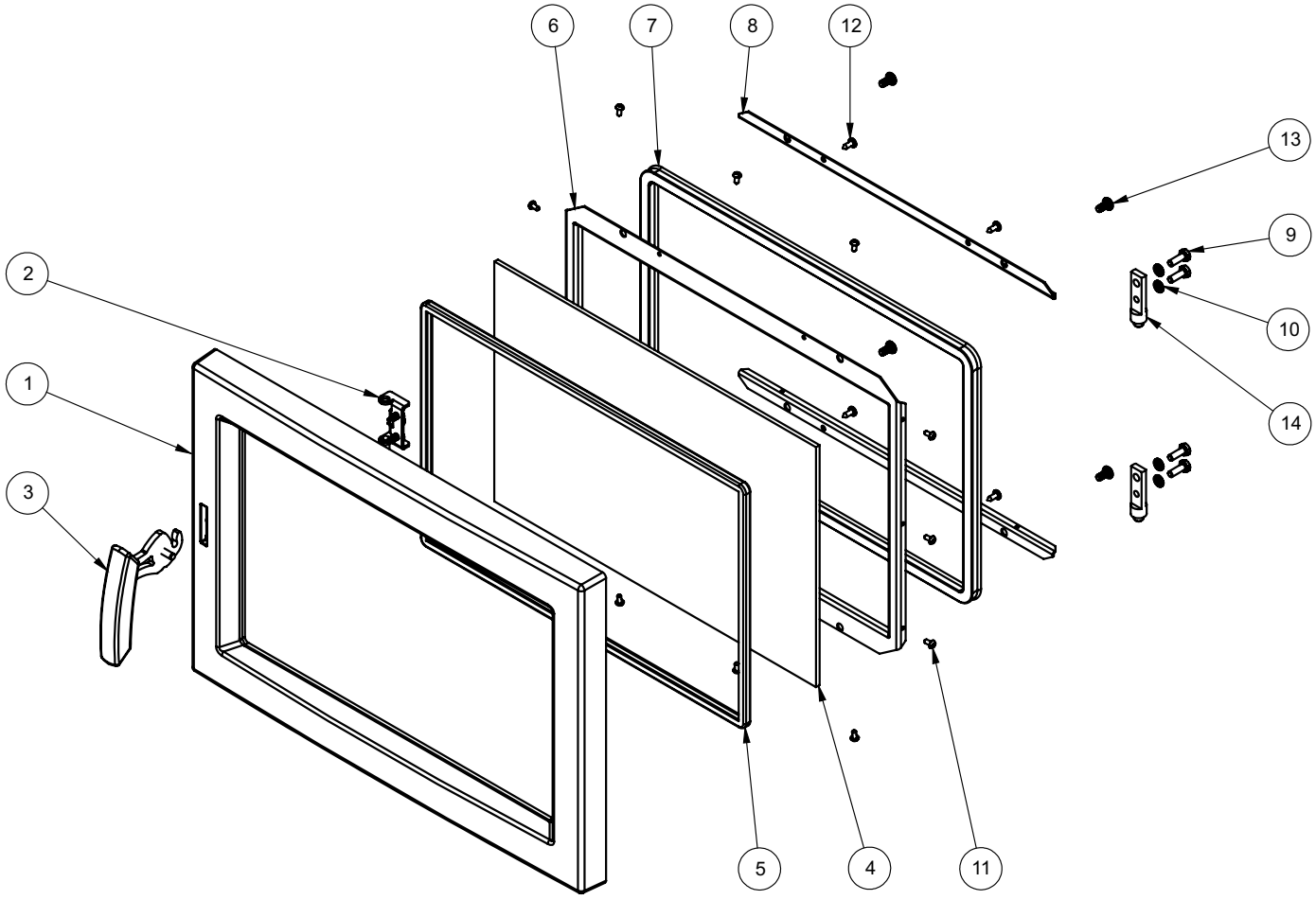
Fire bricks	
#	Size
1	4-1/2" x 9"
2	4" x 9"
3	3-1/2" x 4-1/2"
4	1-3/4" x 4-1/2"
5	4-1/2" x 7-5/8"
6	1-3/4" x 9"



DOOR ASSEMBLY

	Part #	Description
1	042-520	Door cast black (F3500)
2	106-541/P	Aligner assembly
3	156-514	Removable cast handle assembly
4	940-416/P	Door glass
5	943-243	7/8" flat window gasket (per 5ft. - required)
6	042-020	5/8" Gasket Retainer
	106-131F	Door Shims (Each)

	Part #	Description
7	846-530	5/8" Medium Door gasket kit
8	042-021	Gasket bracket
9	904-513	Hex bolt 1/4-20 x 3/4 LG.
10	904-525	Washer 1/4" split lock
11	904-149	SMS #8-18 x 3/8 LG
12	904-146	Screw #10 x 1/2" self tap pan hd philips
13	904-015	1/4-20 x 1/2 pan hd phil
14	948-155	Hinge pin



Limited Lifetime Warranty

FPI Fireplace Products International Ltd. (for Canadian customers) and Fireplace Products U.S., Inc. (for U.S. customers) (collectively referred to herein as "FPI") extends this Limited Lifetime Warranty to the original purchaser of this appliance provided the product remains in the original place of installation. The items covered by this limited warranty and the period of such coverage is set forth in the table below.

Some conditions apply (see below).

The policy is not transferable, amendable, or negotiable under any circumstances.

Wood Products	Component Coverage					Labor Coverage
Components Covered	Limited Lifetime	5 years	2 years	1 year	Warranty	(Years)
Welded Firebox Steel	✓					5
All Stainless Steel Components, Smoke Deflectors, Heat Shields etc.	✓					3
Air Tubes	✓					3
Airmate	✓					3
Door handle and latch assembly, all hardware	✓					3
Glass Thermal Breakage Only	✓					3
Steel Faceplates, Accessory Housings	✓					3
All Plating	✓					3
Ash Drawer, Heatshields, Pedestal	✓					
All Baffles, Steel, Ceramic, Vermiculite C-Baffles	✓					
All castings, firebox, surrounds, doors, panels etc.		✓				3
All Electrical, Blower, wiring, switches etc.			✓			2
Glass - Crazing				✓		1
Catalyst Combustor					*10 Years Prorated	
Venting/Chimney				✓		1
Screens				✓		1

*See specific warranty details in regards to the catalyst combustor in unit manual.

Conditions:

Warranty protects against defect in manufacture or FPI factory assembled components only, unless herein specified otherwise.

Any part(s) found to be defective during the warranty period as outlined above will be repaired or replaced at FPI's option through an accredited distributor, dealer or pre-approved and assigned agent provided that the defective part is returned to the distributor, dealer or agent for inspection if requested by FPI. Alternatively, FPI may at its own discretion fully discharge all of its obligations under the warranty by refunding the verified purchase price of the product to the original purchaser. The purchase price must be confirmed by the original Bill of Sale.

The authorized selling dealer, or an alternative authorized FPI dealer if pre-approved by FPI, is responsible for all in-field diagnosis and service work related to all warranty claims. FPI is not responsible for results or costs of workmanship of unauthorized FPI dealers or agents in the negligence of their service work.
At all times FPI reserves the right to inspect reported complaints on location in the field claimed to be defective prior to processing or authorizing of any claim. Failure to allow this upon request will void the warranty.

All warranty claims must be submitted by the dealer servicing the claim, including a copy of the Bill of Sale (proof of purchase by you). All claims must be complete and provide full details as requested by FPI to receive consideration for evaluation. Incomplete claims may be rejected.

Replacement units are limited to one per warranty term. Airtube and baffle replacements are limited to one replacement per term.

Unit must be installed according to all manufacturers' instructions as per the manual.

All Local and National required codes must be met.

The installer is responsible to ensure the unit is operating as designed at the time of installation.

The original purchaser is responsible for annual maintenance of the unit, as outlined in the owner's manual. As outlined below, the warranty may be voided due to problems caused by lack of maintenance.

Repair/replacement parts purchased by the consumer from FPI after the original coverage has expired on the unit will carry a 90 day warranty, valid with a receipt only. Any item shown to be defective will be repaired or replaced at our discretion. No labor coverage is included with these parts.

Exclusions:
This Limited Lifetime Warranty does not extend to rust or corrosion of any kind due to: a lack of maintenance or improper venting, lack of combustion air provision, or exposure to corrosive chemicals (i.e. chlorine, salt, air, etc.).

This Limited Lifetime Warranty also does not extend to: paint, firebricks (rear, sides, or bottom), door gasketing, glass gasketing (or any other additional factory fitted gasketing), vermiculite floor bricks, andiron assemblies, and flue damper rods.

Malfunction, damage or performance based issues as a result of environmental conditions, location, chemical damages, downdrafts, installation error, installation by an unqualified installer, incorrect chimney components (including but not limited to cap size or type), operator error, abuse, misuse, use of improper fuels (such as unseasoned cordwood, mill-ends, construction lumber or debris, off-cuts, treated or painted lumber, metal or foil, plastics, garbage, solvents, cardboard, coal or coal products, oil based products, waxed cartons, compressed pre-manufactured logs, kiln dried wood), lack of regular maintenance and upkeep, acts of God, weather related problems from hurricanes, tornados, earthquakes, floods, lightning strikes/bolts or acts of terrorism or war, which result in malfunction of the appliance are not covered under the terms of this Limited Lifetime Warranty.

FPI has no obligation to enhance or modify any unit once manufactured (i.e. as products evolve, field modifications or upgrades will not be performed on existing appliances).

This warranty does not cover dealer travel costs for diagnostic or service work. All labor rates paid to authorized dealers are subsidized, pre-determined rates. Dealers may charge homeowner for travel and additional time beyond their subsidy.

Any unit showing signs of neglect or misuse will not be covered under the terms of this warranty policy and may void this warranty. This includes units with rusted or corroded fireboxes which have not been reported as rusted or corroded within three (3) months of installation/purchase.

Units which show evidence of being operated while damaged, or with problems known to the purchaser and causing further damages will void this warranty.

Units where the serial no. has been altered, deleted, removed or made illegible will void this warranty.

Minor movement, expansion and contraction of the steel is normal and is not covered under the terms of this warranty.

FPI is not liable for the removal or replacement of facings or finishing in order to repair or replace any appliance in the field.

Freight damages for products or parts are not covered under the terms of the warranty.

Products made or provided by other manufacturers and used in conjunction with the FPI appliance without prior authorization from FPI may void this warranty.

Limitations of Liability:
The original purchaser's exclusive remedy under this warranty, and FPI's sole obligation under this warranty, express or implied, in contract or in tort, shall be limited to replacement, repair, or refund, as outlined above. IN NO EVENT WILL FPI BE LIABLE UNDER THIS WARRANTY FOR ANY INCIDENTAL OR CONSEQUENTIAL COMMERCIAL DAMAGES OR DAMAGES TO PROPERTY. TO THE EXTENT PERMITTED BY APPLICABLE LAW, FPI MAKES NO EXPRESS WARRANTIES OTHER THAN THE WARRANTY SPECIFIED HEREIN. THE DURATION OF ANY IMPLIED WARRANTY IS LIMITED TO DURATION OF THE EXPRESSED WARRANTY SPECIFIED ABOVE. IF IMPLIED WARRANTIES CANNOT BE DISCLAIMED, THEN SUCH WARRANTIES ARE LIMITED IN DURATION TO THE DURATION OF THIS WARRANTY.

Some U.S. states do not allow limitations on how long an implied warranty lasts, or allow exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you.

Customers located outside the U.S. should consult their local, provincial or national legal codes for additional terms which may be applicable to this warranty.

How to Obtain Warranty Service:
Customers should contact the authorized selling dealer to obtain all warranty and service. In the event the authorized selling dealer is unable to provide warranty / service, please contact FPI by mail at the address listed on the next page. Please include a brief description of the problem and your address, email and telephone contact information. A representative will contact you to make arrangements for an inspection and/or warranty service, by an alternative dealer.

Product Registration and Customer Support:
Thank you for choosing a Regency Fireplace. Regency strives to be a world leader in the design, manufacture, and marketing of hearth products. To provide the best support for your product, we request that you complete a product registration form at http://www.regency-fire.com/Customer-Care/Warranty-Registration.aspx within ninety (90) days of purchase.

Product Registration and Customer Support:

Thank you for choosing a Regency Fireplace. Regency strives to be a world leader in the design, manufacture, and marketing of hearth products. To provide the best support for your product, we request that you complete a product registration form found on our Web Site under Customer Care within ninety (90) days of purchase.

For purchases made in **CANADA or the UNITED STATES**:
http://www.regency-fire.com/Customer-Care/Warranty-Registration.aspx

For purchases made in AUSTRALIA:
http://www.regency-fire.com.au/Customer-Care/Warranty-Registration.aspx

You may also complete the warranty registration form below to register your Regency Fireplace Product and mail and/or fax it back to us, and we will register the warranty for you. It is important you provide us with all the information below in order for us to serve you better.

Warranty Registration Form (or Register online immediately at the above Web Site):

Warranty Details	
Serial Number (required):	
Purchase Date (required) (mm/dd/yyyy):	
Product Details	
Product Model (required):	
Dealer Details	
Dealer Name (required):	
Dealer Address:	
Dealer Phone #:	
Installer:	
Date Installed (mm/dd/yyyy):	
Your Contact Details (required)	
Name:	
Address:	
Phone:	
Email:	

For purchases made in CANADA:

FPI Fireplace Products International Ltd.
6988 Venture St.
Delta, British Columbia
Canada, V4G 1H4

Phone: 604-946-5155
Fax: 1-866-393-2806

For purchases made in the UNITED STATES:

Fireplace Products US, Inc.
PO Box 2189 PMB 125
Blaine, WA
United States, 98231

Phone: 604-946-5155
Fax: 1-866-393-2806

For purchases made in AUSTRALIA:

Fireplace Products Australia Pty Ltd
1- 3 Conquest Way
Hallam, VIC
Australia, 3803

Phone: +61 3 9799 7277
Fax: +61 3 9799 7822

For fireplace care and tips and answers to most common questions please visit our Customer Care section on our Web Site. Please feel free to contact your selling dealer if you have any questions about your Regency product.

CATALYTIC COMBUSTOR WARRANTY COVERAGE

IMPORTANT WARRANTY INFORMATION FOR CATALYTIC COMBUSTOR
Effective March 1 2019

Any and all claims for catalytic combustor must be filed **by the consumer** directly with their authorized Regency Dealer. FPI/Regency does not handle these claims directly with consumers.

Please follow the instructions below for your catalytic combustor under warranty. To learn more about the care and maintenance or the catalytic combustor, please visit our website: www.firecatcombustors.com.

Any warranty coverage before this date will be covered by the original warranty when the appliance was purchased.

(1) **10-year** coverage from Regency – not the supplier of the catalytic combustor.

(2) All claims must be made through the dealer where the appliance had been purchased.

(3) One no-charge replacement at any time within the **ten (10) year** period.

(4) Second replacement at 50% off retail* within the original **ten (10) years**.

(5) Subsequent replacements or if **ten (10)-year** coverage has expired at full retail* price.

(6) The catalytic combustor must not have been mechanically abused, nor must the wrong fuels have been used in the appliance.

(7) All claims must be accompanied by clear photos of the catalytic combustor showing all damage and also showing existing internal venting from the stove.

The consumer will be responsible for removal, any servicing. This warranty is REGENCY® exclusive warranty and REGENCY® disclaims any other express or implied warranty for the catalytic combustor, including any warranty or merchantability of fitness for a particular use.
NO LABOR WILL APPLY.

All warranty claims must be sent to: Regency Fireplace Products
By Authorized Regency Dealer

* Prices subject to change.
Regency reserves the right to reject any claim if it is determined the damage is a result of misuse, abuse or improper cleaning/ handling.

notes

Installer: Please complete the following information

Dealer Name & Address:_____

_____

Installer: _____

Phone #: _____

Date Installed: _____

Serial #:_____

Printed in Canada

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

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

Report Number: DIRI01A05026180111

A2LA ACCREDITED
CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Scale	Rice Lake	IQ+355E-2A x 100(	A05026	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
lbs	1	QC033	1/11/18	6/27/17	6/2018

FUNCTIONAL CHECKS

SHIFT TEST	LINEARITY	REPEATABILITY	ENVIRONMENTAL CONDITIONS
Test Wt: 250 Tol: 1	Test Wt: HB44 Tol: HB44	Test Wt: 100 Tol: 1	☐ Good ☑ Fair ☐ Poor
As-Found: Pass:☑ Fail:☐	As-Found: Pass:☑ Fail:☐	As-Found: Pass:☑ Fail:☐	Temperature: 17.7°C
As-Left: Pass:☑ Fail:☐	As-Left: Pass:☑ Fail:☐	As-Left: Pass:☑ Fail:☐	

CALIBRATION DATA

Standard	As-Found	As-Left	Expanded Uncertainty
1000	1000.1	1000.1	0.5
700	700.3	700.3	0.5
500	499.8	499.8	0.5
300	300.0	300.0	0.5
100	100.0	100.0	0.5
50	50.0	50.0	0.5

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:
2000lbs platform. Has a custom pan.

Comments/Information Concerning this Calibration
1/18 RH = 58.5

Report prepared/reviewed by: _____ **Date:** 1-11-18

Technician: D. Oudeans
Signature: D-Oud

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.

Established 1974

QUALITY CONTROL SERVICES

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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

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

Report Number: DIRI0182484A0912013i180613

A2LA ACCREDITED
CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Scale	Digiweigh	DWP12i 400x.01	82484A0912013i	#050	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
lbs	0.01	QC033	6/13/18	1/11/18	12/2018

FUNCTIONAL CHECKS

SHIFT TEST	LINEARITY	REPEATABILITY	ENVIRONMENTAL CONDITIONS
Test Wt: 50 Tol: 0.05	Test Wt: HB44 Tol: HB44	Test Wt: 50 Tol: 0.01	☐ Good ☑ Fair ☐ Poor
As-Found: Pass:☑ Fail:☐	As-Found: Pass:☑ Fail:☐	As-Found: Pass:☑ Fail:☐	Temperature: 22.2°C
As-Left: Pass:☑ Fail:☐	As-Left: Pass:☑ Fail:☐	As-Left: Pass:☑ Fail:☐	

CALIBRATION DATA

Standard	As-Found	As-Left	Expanded Uncertainty
400	399.98	399.98	0.058
300	300.00	300.00	0.058
200	200.00	200.00	0.058
100	100.00	100.00	0.012
50	50.00	50.00	0.012
20	20.00	20.00	0.012

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
Weight Set	Rice Lake	.001 to 10lb	PW0990	9/23/16	9/2018	20161896

Permanent Information Concerning this Equipment:

6 month calibration cycle. Relative humidity= 56%.

Comments/Information Concerning this Calibration

Report prepared/reviewed by: Jake C **Date:** 6/13/18

Technician: J. Colacchio
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.

Dry Gas Meter Calibration

Meter Manufacturer:	Apex
Model:	XC-60-ED
Lab ID #:	053
Serial #:	1902130
Calibration Date:	6/13/2018
Calibration Expiration:	12/13/2018
Barometric Pressure:	29.84 in. Hg

Reference Standard DGM	
Manufacturer:	Apex
Model:	SK25DA
Lab ID#:	047
Serial #:	1101001
Calibration Expiration Date:	3/5/2019
Calibration γ Factor:	0.998

Unit Under Test Previous Calibration	
Date	1/10/2018
γ Factor:	0.995
Allowable Deviation (±5%):	0.04975
Actual Deviation:	0.01
Result:	PASS

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	144.977	146.222	201.016
Standard DGM Temperature (°F)	73.2	73.0	72.0
Standard DGM Pressure (in H_2O)	0.00	0.00	0.0
DGM Initial Volume (ft^3)	0.000	0.000	0.000
DGM Final Volume (ft^3)	5.194	5.278	7.307
DGM Temperature (°F)	84.0	90.0	94.0
DGM Pressure (in H_2O)	2.10	2.58	1.4
Time (min)	36.0	32.0	60.0
Net Volume for Standard DGM (ft^3)	5.120	5.164	7.099
Net Volume for DGM (ft^3)	5.194	5.278	7.307

Dry Gas Meter γ Factor	0.999	1.001	1.006
γ Factor Deviation From Average	0.999	1.001	1.006

Average Gas Meter γ Factor: 1.002

Calculations:

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

Standard Reference Meter is calibrated to NIST traceable standards. Uncertainty of measurement is ±0.5%.

Dry Gas Meter Calibration

Meter Manufacturer:	Apex
Model:	XC-60-ED
Lab ID #:	054
Serial #:	1902133
Calibration Date:	6/13/2018
Calibration Expiration:	12/13/2018
Barometric Pressure:	29.84 in. Hg

Reference Standard DGM	
Manufacturer:	Apex
Model:	SK25DA
Lab ID#:	047
Serial #:	1101001
Calibration Expiration Date:	3/5/2019
Calibration γ Factor:	0.998

Unit Under Test Previous Calibration	
Date	1/11/2018
γ Factor:	1.000
Allowable Deviation (±5%):	0.05
Actual Deviation:	0.00
Result:	PASS

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	158.715	148.505	236.136
Standard DGM Temperature (°F)	72.5	73.2	73.0
Standard DGM Pressure (in H_2O)	0.00	0.00	0.0
DGM Initial Volume (ft^3)	0.000	0.000	0.000
DGM Final Volume (ft^3)	5.777	5.426	8.616
DGM Temperature (°F)	93.5	94.0	90.0
DGM Pressure (in H_2O)	2.50	2.00	1.5
Time (min)	37.0	38.5	71.5
Net Volume for Standard DGM (ft^3)	5.605	5.244	8.339
Net Volume for DGM (ft^3)	5.777	5.426	8.616

Dry Gas Meter γ Factor	1.000	0.997	0.993
γ Factor Deviation From Average	1.000	0.997	0.993

Average Gas Meter γ Factor: 0.997

Calculations:

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

Standard Reference Meter is calibrated to NIST traceable standards. Uncertainty of measurement is ±0.5%.

Dry Gas Meter Calibration

Meter Manufacturer:	Apex
Model:	Apex-AK-600
Lab ID #:	055
Serial #:	810016
Calibration Date:	6/15/2018
Calibration Expiration:	6/15/2019
Barometric Pressure:	29.83 in. Hg

Reference Standard DGM	
Manufacturer:	Apex
Model:	SK25DA
Lab ID#:	047
Serial #:	1101001
Calibration Expiration Date:	3/5/2019
Calibration γ Factor:	0.998

Unit Under Test Previous Calibration	
Date	1/18/2017
γ Factor:	0.997
Allowable Deviation (±5%):	0.04985
Actual Deviation:	0.00
Result:	PASS

Calibration Data	Run 1	Run 2	Run 3
Standard DGM Initial Volume (L)	0.000	0.000	0.000
Standard DGM Final Volume (L)	145.479	148.058	143.802
Standard DGM Temperature (°F)	71.0	71.0	71.0
Standard DGM Pressure (in H_2O)	0.00	0.00	0.0
DGM Initial Volume (ft^3)	0.000	0.000	0.000
DGM Final Volume (ft^3)	5.146	5.254	5.114
DGM Temperature (°F)	75.0	76.5	77.5
DGM Pressure (in H_2O)	1.80	1.80	1.8
Time (min)			
Net Volume for Standard DGM (ft^3)	5.138	5.229	5.078
Net Volume for DGM (ft^3)	5.146	5.254	5.114

Dry Gas Meter γ Factor	0.999	0.999	0.999
γ Factor Deviation From Average	0.999	0.999	0.999

Average Gas Meter γ Factor: 0.999

Calculations:

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

Standard Reference Meter is calibrated to NIST traceable standards. Uncertainty of measurement is ±0.5%.

Established 1974

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ACCREDITED

Calibration Services

Certificate Number: 1550.01

Laboratory code: 115953

Report of Calibration

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

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

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

Manufacturer: Troemner

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

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

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

Conventional Mass: "The conventional value of the result of weighing a body in air is equal to the mass of a standard, of conventionally chosen density, at a conventionally chosen temperature, which balances this body at this reference temperature in air of conventionally chosen density. International Recommendation 33 (OIML IR 33 1973, 1979). "Conventional Value of the Result of Weighing in Air" **(Previously known as "Apparent Mass vs. 8.0g/cm^3).**

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

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

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

Date: 03/21/17

Signature David S. Thompson

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ACCREDITED

Calibration Services

Certificate Number: 1550.01

Laboratory code: 115953

Report of Calibration

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

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

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

Manufacturer: Troemner

Laboratory Environment at time of test

Temperature °C	Pressure mmHg	Humidity %RH
21.967	753.44	49.44

Conventional Mass Value

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

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

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

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

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

Date: 03/21/17

Signature David S. Thompson

Established 1974

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ACCREDITED
Calibration Services
Certificate Number: 1550.01
Laboratory code: 115953

Report of Calibration

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

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

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

Manufacturer: Unknown

Laboratory Environment at time of test

Temperature °C	Pressure mmHg	Humidity %RH
21.448	760.64	44.58

Conventional Mass Value

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

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

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

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

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

Date: 01/15/16

Signature David S. Thompson

Established 1974

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A2LA ACCREDITED
CERTIFICATE #1550.01

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

Report Number: DIRI0134307497180613

A2LA ACCREDITED
CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	ENTRIS224-1S	34307497	#107	Lab

Units	Readability	SOP	Cal Date	Last Cal Date	Cal Due Date
g	0.0001	QC012	6/13/18	1/11/18	12/2018

FUNCTIONAL CHECKS

ECCENTRICITY
Test Wt: 100 Tol: 0.0003
As-Found: Pass: ☑ Fail: ☐
As-Left: Pass: ☑ Fail: ☐

LINEARITY
Test Wt: 50 x 4 Tol: 0.0002
As-Found: Pass: ☑ Fail: ☐
As-Left: Pass: ☑ Fail: ☐

STANDARD DEVIATION
Test Wt: 100 Tol: 0.0001

1. 100.0000	5. 100.0001	9. 100.0001
2. 100.0000	6. 100.0001	10. 100.0001
3. 100.0000	7. 100.0001	Result
4. 100.0000	8. 100.0001	0.00005

ENVIRONMENTAL CONDITIONS
☐ Good ☑ Fair ☐ Poor
Temperature: 22.8°C

A2LA ACCREDITED SECTION OF REPORT

Standard	As-Found	As-Left	Expanded Uncertainty
200	199.9980	200.0000	0.00015
100	99.9991	100.0000	0.00015
50	49.9995	50.0001	0.00015
20	19.9998	20.0000	0.00015
1	1.0000	1.0000	0.00015
0.1	0.1000	0.1000	0.00015

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	Rice Lake	20 kg to 1mg	2831W	1/3/18	1/2019	20152429

Permanent Information Concerning this Equipment:
6 month calibration cycle. Relative humidity= 47%

Comments/Info Concerning this Calibration:
6/13/18: Adjusted span.

Report prepared/reviewed by: Jake C **Date:** 6/13/18

Technician: J. Colacchio
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 and readability of the unit under test. The uncertainty is expanded with a k factor of 2 for an approximate 95% level of confidence. Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

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NIST Traceable
Calibration Report

REPORT NUMBER
1375092

Reference Number: 1200788
PO Number: JSTEINERT013118

PFS-TECO
11785 SE Highway 212
Suite 305
Clackamas, OR 97015 United States

Manufacturer:	Dwyer Instruments Inc.	**Calibration Date:**	02/14/2018
Model Number:	471	**Calibration Due Date:**	02/14/2019
Description:	Air Velocity, Digital Thermo Anemometer	**Condition As Found:**	Limited In Tol See Comments
Asset Number:	#095	**Condition As Left:**	Limited See Comments
Serial Number:	#095		
Procedure:	DS Universal Speed/Time/Temperature		

Remarks:

NIST-traceable calibration performed on the unit referenced above in accordance with customer requirements, published specifications and the lab's standard operating procedures. No adjustments were made to the unit.

This calibration is considered limited due to the requested test range.

Standards Utilized

Asset No.	Manufacturer	Model No.	Description	Cal. Date	Due Date
CP105979	Kanomax	X5602	Air Velocity, Wind Tunnel, Open Jet	01/06/2018	01/31/2019
CP144554	Fluke Corporation	1551A EX	Temperature, Stik Thermometer	01/08/2018	01/31/2019

Calibration Data

FUNCTION TESTED	Nominal Value	As Found	Out of Tol	As Left	Out of Tol	CALIBRATION TOLERANCE
Speed Accuracy Air Velocity	50 ft/min	43		Same		35 to 65 ft/min [EMU 1.3 ft/min][TUR 12:1]
Speed Accuracy Air Velocity	100 ft/min	90		Same		85 to 115 ft/min [EMU 1.5 ft/min][TUR 9.8:1]
Speed Accuracy Air Velocity	150 ft/min	140		Same		135 to 165 ft/min [EMU 1.8 ft/min][TUR 8.3:1]
Speed Accuracy Air Velocity	200 ft/min	192		Same		185 to 215 ft/min [EMU 2.1 ft/min][TUR 7.1:1]
Speed Accuracy Air Velocity	250 ft/min	240		Same		235 to 265 ft/min [EMU 2.4 ft/min][TUR 6.2:1]
Speed Accuracy Air Velocity	300 ft/min	288		Same		285 to 315 ft/min [EMU 2.7 ft/min][TUR 5.6:1]
Speed Accuracy Air Velocity	400 ft/min	395		Same		385 to 415 ft/min [EMU 3.3 ft/min][TUR 4.5:1]
Speed Accuracy Air Velocity	500 ft/min	485		Same		485 to 515 ft/min [EMU 3.9 ft/min][TUR 3.8:1]
Temperature Accuracy	72.0 °F	71.9		Same		70.0 to 74.0 °F [EMU 0.11 °F][TUR 18:1]

Temperature: 23° C
Humidity: 20% RH
Rpt. No.: 1375092

Calibration Performed By:				Quality Reviewer:	
Mathews, Rich	314	Metrologist	847-327-5314	Szplit, Tony	02/14/2018
Name	ID #	Title	Phone	Name	Date

Model 1430 Microtector® Electronic Point Gage

Installation and Operating Instructions

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

SPECIFICATIONS AND FEATURES

- Accurate and repeatable to ± .00025 inches water column
- Pressure range: 0 - 2″ w.c., positive, negative, or differential pressures
- Non-toxic and inexpensive gage fluid consists of distilled water mixed with a small amount of fluorescein green color concentrate
- Convenient, portable, lightweight and self-contained, the unit requires no external power connections and is operated by a 1.5 volt penlight cell
- A.C. detector current eliminates point plating, fouling and erosion
- Micrometers are manufactured in accordance with ASME B89.1.13-2001, and are traceable to a standard at the National Institute of Standards and Technology
- Three-point mounting, dual leveling adjustment, and circular level vial assure rapid setup
- Durablock® precision-machined acrylic plastic gage body
- Sensitive 0 - 50 microamp D.C. meter acts as a detector and also indicates battery and probe condition
- Heavy 2″ thick steel base plate provides steady mounting
- Top-quality glass epoxy circuit board and solid-state, integrated circuit electronics
- Electronic enclosure of tough, molded styrene acrylonitrile provides maximum protection to components yet allows easy access to battery compartment
- Rugged sheet steel cover and carrying case protects the entire unit when not in use
- Accessories included are (2) 3-foot lengths Tygon® tubing, (2) 1/8″ pipe thread adapters and 3/4 oz. bottle of fluorescein green color concentrate with wetting agent

Maximum pressure: 100 psig with optional pipe thread connections.

Tygon® is a registered trademark of Saint-Gobain Corporation

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Los Angeles, CA 90058
Tel: (323) 585-2154 Fax:(714) 542-6689
PGVPID: F22017

DocNumber: 000113537

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information:

PXPKG TUALATIN OR H
10450 SW TUALATIN SHERWOOD
TUALATIN OR 97062

Praxair Order Number: 70337802
Customer P. O. Number:
Customer Reference Number:

Fill Date: 8/7/2017
Part Number: NI CD17CO8E-AS
Lot Number: 70086721903
Cylinder Style & Outlet: AS CGA 590
Cylinder Pressure & Volume: 1290 psig 99 cu. ft.

Certified Concentration:

Expiration Date: 8/11/2025
Cylinder Number: CC700832

			NIST Traceable Analytical Uncertainty:
4.33	%	CARBON MONOXIDE	± 0.5 %
16.93	%	CARBON DIOXIDE	± 0.3 %
16.99	%	OXYGEN	± 0.3 %
Balance		NITROGEN	± 0.2 %

Certifcation Information: *Certification Date:* 8/11/2017 *Term:* 96 Months *Expiration Date:* 8/11/2025
This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1. Do Not Use this Standard if Pressure is less than 100 PSIG.

CO2 responses have been corrected for O2 IR boardening effect. O2 responses have been corrected for CO2 interference.

Analytical Data: *(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)*

1. Component: CARBON MONOXIDE

Requested Concentration: 4.25 %
Certified Concentration: 4.33 %
Instrument Used: Horiba VIA-510 S/N UB9UCSYX
Analytical Method: NDIR
Last Multipoint Calibration: 7/23/2017

First Analysis Data: Date: 8/11/2017

Z:	0	R:	5	C:	4.33	Conc: 4.333
R:	4.99	Z:	0	C:	4.33	Conc: 4.333
Z:	0	C:	4.32	R:	5	Conc: 4.323

UOM: % Mean Test Assay: 4.33 %

Reference Standard Type: GMIS
Ref. Std. Cylinder # : CC242633
Ref. Std. Conc: 5.00%
Ref. Std. Traceable to SRM # : 2642a
SRM Sample # : 51-D-23
SRM Cylinder # : FF23106

Second Analysis Data: Date:

Z:	0	R:	0	C:	0	Conc: 0
R:	0	Z:	0	C:	0	Conc: 0
Z:	0	C:	0	R:	0	Conc: 0

UOM: % Mean Test Assay: 0 %

2. Component: CARBON DIOXIDE

Requested Concentration: 17 %
Certified Concentration: 16.93 %
Instrument Used: Horiba VIA-510 S/N 20C194WK
Analytical Method: NDIR
Last Multipoint Calibration: 7/20/2017

First Analysis Data: Date: 8/11/2017

Z:	0	R:	20.08	C:	16.99	Conc: 16.936
R:	20.08	Z:	0	C:	16.99	Conc: 16.936
Z:	0	C:	16.98	R:	20.09	Conc: 16.926

UOM: % Mean Test Assay: 16.933 %

Reference Standard Type: GMIS
Ref. Std. Cylinder # : SA10234
Ref. Std. Conc: 20.02%
Ref. Std. Traceable to SRM # : RGM#CC28
SRM Sample # : N/A
SRM Cylinder # : RGM#CC28033

Second Analysis Data: Date:

Z:	0	R:	0	C:	0	Conc: 0
R:	0	Z:	0	C:	0	Conc: 0
Z:	0	C:	0	R:	0	Conc: 0

UOM: % Mean Test Assay: 0 %

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DocNumber: 223791

Praxair Distribution, Inc.
5700 S. Alameda Street
Los Angeles CA 90058
Tel: 323-585-2154
Fax: 714-542-6689
PGVP ID: F22018

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information

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

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

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

Certified Concentration

ProSpec EZ Cert

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

Certification Information:

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

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

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

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

Analytical Data:

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

1. ***Component:*** **Carbon dioxide**

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

First Analysis Data: **Date** 09/05/2018

Z:	0	R:	14.02	C:	10	Conc:	10
R:	14.02	Z:	0	C:	10	Conc:	10
Z:	0	C:	10	R:	14.02	Conc:	10

UOM: % **Mean Test Assay:** 10 %

Reference Standard: Type / Cylinder #: GMIS / CC141375
Concentration / Uncertainty: 14.02 % ±0.3%
Expiration Date: 06/11/2026
Traceable to: SRM # / Sample # / Cylinder #: SRM 1675b / 6-F-51 / CAL014538
SRM Concentration / Uncertainty: 13.963% / ±0.034%
SRM Expiration Date: 05/16/2022

Second Analysis Data: **Date**

Z:	0	R:	0	C:	0	Conc:	0
R:	0	Z:	0	C:	0	Conc:	0
Z:	0	C:	0	R:	0	Conc:	0

UOM: % **Mean Test Assay:** %

2. ***Component:*** **Carbon monoxide**

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

First Analysis Data: **Date** 09/05/2018

Z:	0	R:	2.48	C:	2.51	Conc:	2.51
R:	2.48	Z:	0	C:	2.51	Conc:	2.51
Z:	0	C:	2.51	R:	2.48	Conc:	2.51

UOM: % **Mean Test Assay:** 2.51 %

Reference Standard: Type / Cylinder #: GMIS / CC102045
Concentration / Uncertainty: 2.48 % ±0.448%
Expiration Date: 04/03/2025
Traceable to: SRM # / Sample # / Cylinder #: SRM 2641a / 52-D-30 / CAL017193
SRM Concentration / Uncertainty: 4.009% / ±0.017%
SRM Expiration Date: 07/15/2019

Second Analysis Data: **Date**

Z:	0	R:	0	C:	0	Conc:	0
R:	0	Z:	0	C:	0	Conc:	0
Z:	0	C:	0	R:	0	Conc:	0

UOM: % **Mean Test Assay:** %

3. ***Component:*** **Oxygen**

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

First Analysis Data: **Date** 09/05/2018

Z:	0	R:	9.88	C:	10.49	Conc:	10.49
R:	9.88	Z:	0	C:	10.5	Conc:	10.5
Z:	0	C:	10.5	R:	9.88	Conc:	10.5

UOM: % **Mean Test Assay:** 10.5 %

Reference Standard: Type / Cylinder #: NTRM / DT0010402
Concentration / Uncertainty: 9.88 % ±0.4%
Expiration Date: 11/18/2022
Traceable to: SRM # / Sample # / Cylinder #: NTRM #170701 / N/A / NTRM #DT0010402
SRM Concentration / Uncertainty: 9.875% / ±0.040%
SRM Expiration Date: 11/18/2022

Second Analysis Data: **Date**

Z:	0	R:	0	C:	0	Conc:	0
R:	0	Z:	0	C:	0	Conc:	0
Z:	0	C:	0	R:	0	Conc:	0

UOM: % **Mean Test Assay:** %

Analyzed By: Danielle Burns

Certified By: Jose Vasquez

Report and Certificate of Calibration

CAL-CERT
CALIBRATION CERTIFICATION

6709 SE Lake Road
Milwaukie, OR 97222
1-800-356-4662
CL-108

www.Cal-Cert.com
"Measure The Difference"

14 Inverness Drive East, Ste B-128
Englewood, CO 80112
1-800-983-7832
CL-157

ACCREDITED
Calibration Laboratory

Report #:	2260-28789-46	**Customer PO#:**	
Customer Name:	PFS TECO		
Customer Address:	11785 Southeast Highway 212		
City:	Clackamas	**State:** OR	**Zip:** 97015
Contact:	John Steinert		
Service Address:	6709 Southeast Lake Road	Milwaukie, OR 97222	

Calibration Standards

10-RH/00192 Comark Thermohygrometer S/N: 6217150049 Cal Date: 11/17/17 Due Date: 11/30/18 Vendor: Cal-Cert REPORT # 1573-C-01
10-SR1/00515 SPI Steel Rule S/N: 00515 Cal Date: 3/21/17 Due Date: 3/21/18 Vendor: Cal-Cert REPORT# 59499-C-07

Instrument Data

Calibration Date:	January 25, 2018	**Reference:**	Manufacturer's Spec
Calibration Due Date:	January 25, 2019	**Cal-Cert Procedure:**	CP-115
Calibration Frequency:	12 Months	**Indicating System:**	Scaling
Manufacturer:	Dewalt	**Temperature:**	71 °F
Type:	Tape Measure	**Humidity:**	29% RH
Model Number:	DWHT33372	**Asset #:**	#090
Serial #:	#1 TAPE	**Service Location:**	Cal-Cert Lab
Capacity:	192 Inches	**As Found:**	Pass
		As Left:	Pass

Instrument Range: 192.000 Inches **Range Resolution:** 0.0625 Inches

Calibration Standard	As Found Reading	Verification Reading #1	Verification Reading #2
0.000	0.000	0.000	0.000
0.063	0.063	0.063	0.063
1.000	1.000	1.000	1.000
12.000	12.000	12.000	12.000
48.000	48.000	48.000	48.000
96.000	96.000	96.000	96.000
192.000	192.000	192.000	192.000

Expanded Uncertainty ± 0.07217 Inches

Remarks:

We sincerely thank you for your business. Please call us at 1-800-356-4662 for all your sales and calibration needs.
Cleaning and preventative maintenance were performed as part of this service.

Cal-Cert is accredited by the International Accreditation Service, Inc. (IAS) under Calibration Laboratory Code CL-108 & CL-157.
IAS is recognized under the ILAC mutual recognition agreement (MRA).

This certificate is hereby issued that the above instrument was tested for accuracy with calibrated standards traceable to the National Institute of Standards and Technology (NIST). The information provided on this form complies with the data gathering and reporting requirements of ISO/IEC 17025 and ANSI/NCSL Z540.3, and meets the requirements of all applicable references and Cal-Cert procedures listed above.
Any stated measurement uncertainty includes the uncertainty of the Calibration standards used, combined with the uncertainty of the measurement process using the RSS method with a k=2 for an approximate 95% level of confidence. The calibration process meets or exceeds a ratio of 4:1 unless otherwise stated.
All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

Service Engineer:	TYSON MORAN	**Date:**	January 25, 2018
Technical Manager:	MARSHALL DOYLE	**Signature:**	MDoyle

Report and Certificate of Calibration

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Englewood, CO 80112
1-800-983-7832
CL-157

ACCREDITED
Calibration Laboratory

Report #:	2260-28781-66	**Customer PO#:**	
Customer Name:	PFS TECO		
Customer Address:	11785 SE Highway 212		
City:	Clackamas	**State:** OR	**Zip:** 97015
Contact:	John Steinert		
Service Address:	6709 SE Lake Road, Milwaukie, OR 97222		

Calibration Standards

10-RH/00192 Comark Thermohygrometer S/N: 6217150049 Cal Date: 11/17/17 Due Date: 11/30/18 Vendor: CC REPORT # 1573-C-01
L-GB-0/00397 Mitutoyo 83 Piece Gage Block Set S/N: 0509020 Cal Date: 9/8/16 Due Date: 9/30/18 Vendor: American Gage REPORT#: 83181-2-354224

Instrument Data

Calibration Date:	January 23, 2018	**Reference:**	NAVAIR 17-20MD-07
Calibration Due Date:	January 23, 2019	**Cal-Cert Procedure:**	CP-008
Calibration Frequency:	12 Months	**Indicating System:**	Digital
Manufacturer:	General	**Temperature:**	72 °F
Type:	Digital Caliper	**Humidity:**	31% RH
Model Number:	147	**Asset #:**	#092
Serial #:	#092	**Service Location:**	Cal-Cert Lab
Capacity:	6 Inches	**As Found:**	PASS
Resolution:	0.0005 Inches	**As Left:**	PASS

Instrument Range: 6 Inches **Range Resolution:** 0.0005 Inches

Outside Jaws / Linearity

Calibration Standard Inches	As Found Inches	As Left Reading 1 Inches	As Left Reading 2 Inches	Tolerance ± Inches
0.0000	0.0000	0.0000	0.0000	0.0000
0.0500	0.0500	0.0500	0.0500	0.0010
0.3000	0.3000	0.3000	0.3005	0.0010
0.6000	0.6000	0.6000	0.6000	0.0010
1.2000	1.2005	1.2005	1.2000	0.0010
2.4000	2.4000	2.4000	2.4005	0.0010
3.5000	3.5000	3.5000	3.5000	0.0010
5.0000	5.0000	5.0000	5.0000	0.0010
6.0000	6.0000	6.0000	6.0000	0.0010

Expanded Uncertainty ± 0.00129 Inches

Verifications (for information only)

	Target	Measured	Tolerance ±
Resolution Check	0.10050	0.10050	N/A
Depth	1.000	1.00000	N/A
Step	1.000	1.00000	N/A
Inside Jaws	1.000	1.00000	N/A

Inspections

Jaws Parallel	Acceptable

Remarks:

We sincerely thank you for your business. Please call us at 1-800-356-4662 for all your sales and calibration needs.
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Any stated measurement uncertainty includes the uncertainty of the Calibration standards used, combined with the uncertainty of the measurement process using the RSS method with a k=2 for an approximate 95% level of confidence. The calibration process meets or exceeds a ratio of 4:1 unless otherwise stated.

All tolerances were derived from the applicable standards and pass/fail determination is based on those tolerances. The customer determined any recommended due dates indicated on the certificate.

Service Engineer:	NICOLAS ILLA	**Date:**	January 23, 2018
Technical Manager:	MARSHALL DOYLE	**Signature:**	MDoyle

J-2000

owner's manual

DELMHORST®
INSTRUMENT CO.

WHEN ACCURACY IS THE POINT.™

ACCREDITED
A2LA Certificate No. 1750.01
Calibration

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

Cert. No.: 4198-9765787

Traceable® Certificate of Calibration for Hand Held Barometer

Customer :PFS TECO Suite 305 ,11785 SE Highway 212 ,Clackamas ,OR-97015 ,U.S.A.

Instrument Identification:

Model: 4198, S/N: 80531676 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Digital Barometer	D4540001	09 Oct 2018	1000415948
Digital Thermometer	111879345	09 Apr 2019	4000-9377595

Certificate Information:

Technician: 57 Procedure: CAL-32 Cal Date: 29 Aug 2018 Cal Due Date: 29 Aug 2019

Test Conditions: 62.73%RH 23.92°C 1018mBar

Calibration Data:

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
°C	24.10	24.1	Y	23.51	23.9	Y	22.01	25.01	0.05	>4:1
mb/hPa	551.55	552	Y	551.62	546	Y	544	560	0.62	>4:1
mb/hPa	751.22	744	Y	748.87	746	Y	741	757	0.62	>4:1
mb/hPa	1015.90	1011	Y	1018.22	1017	Y	1010	1026	0.62	>4:1

This certificate indicates Traceability to standards provided by (NIST) National Institute of Standards and Technology and/or a National Standards Laboratory.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement : (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ± U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=±(Max-Min)/2; Min=As Left Nominal(Rounded) – Tolerance; Max= As Left Nominal(Rounded) + Tolerance;

Nicol Rodriguez

Nicol Rodriguez, Quality Manager

Aaron Judice

Aaron Judice. Technical Manager

Note :

Maintaining Accuracy:

In our opinion once calibrated your Hand Held Barometer should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Hand Held Barometer change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 12554 Galveston RD Suite B230 Webster TX USA 77598
Phone 281 482-1714 Fax 281 482-9448 sales@control3.com www.control3.com

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Control Company is ISO 9001:2008 Quality Certified by DNV GL, Certificate No. CERT-01805-2006-AQ-HOU-RvA.
International Laboratory Accreditation Cooperation (ILAC) - Multilateral Recognition Arrangement (MRA).