
Foyer Supreme Inc.

**Model – Duet AKA: Duet 4
Seasons, Vision EPA
Certification Testing
Project # 019-S-015-1**

Prepared by Dirigo Laboratories, Inc.
October 9, 2013



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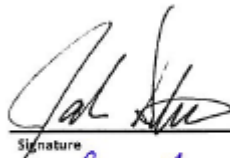
Affidavit:

Dirigo Laboratories, Inc. was contracted by Foyer-Supreme to provide testing services to the Duet model residential wood fired heater per EPA Method 28. All testing and associated procedures were conducted at Foyer Supreme, Inc. beginning 9/9/2013 and ending on 9/13/2013. Foyer Supreme, Inc. is located at 3594 Jarry East, Montreal, Quebec H1Z-2G4 - CANADA. All EPA protocols from Methods 1, 2, 3, 4, 5 and 28 were followed in the testing, sampling, analysis, and calibrations for these tests and all results are based on these methods. Particulate sampling was performed per EPA Method 5G sampling option 3 and ASTM E2515 *Standard Test Method for Determination of Particulate Matter Emissions Collected in a Dilution Tunnel*. Efficiency was calculated using CAN/CSA-B415.1-10 *Performance Testing of Solid-Fuel Burning Heating Appliances*.

Dirigo Laboratories is accredited by the U.S. Environmental Protection Agency for the certification and auditing of wood heaters pursuant to subpart AAA of 40 CFR Part 60, New Source Performance Standards For Residential Wood Heaters- Methods 28, 28A, 28 OWHH, 5G, 5H. Certificate Numbers 9 and 9M (mobile). See Appendix H for Certification.

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

John Steinert, President

 10/16/13
Signature Date

Gary Nelke CMfgE, Vice-President

 10/16/13
Signature Date

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Introduction:

Foyer Supreme, Inc.- located at 3594 Jarry East, Montreal, Quebec –CANADA, contracted with Dirigo Laboratories, Inc. to perform EPA certification testing on their Galaxy insert wood stove. Efficiency testing was also performed per CSA B-415.1-10 “Performance Testing of Solid-Fuel Burning Heating Appliances”. All testing was performed at the facilities of Foyer Supreme, Inc. Testing was performed by Mr. Gary Nelke CMfgE, Vice President of Dirigo Laboratories, Inc.

Technician Notes:

Prior to start of testing, the dilution tunnel was cleaned with a steel brush.

The Duet utilizes a thermostatically controlled convection blower. All runs were performed with the blower set to the maximum setting.

Burn Rate Discussion:

The Duet was unable to be operated at a burn rate less than 0.8 0 kg/hr which required the running of two category 2 runs. Per Method 28 section 8.1.1.3.2 **NOTE** - both runs had an average burn rate of less than 1.0 kg/hr. No flue dampering was required.

Wood Heater Identification and Testing:

- Appliance Tested: *Foyer Supreme, Duet- AKA: 4 Seasons; Vision*
- Serial Number: *DT1001*
- Manufacturer: *Foyer Supreme, Inc.*
- Catalyst: *No*
- Heat exchange blower: *Integral*
- Type: *Wood Stove*
- Style: *Insert*
- Date Received: *N/A*
- Wood Heater Aging: *September 9, 2013 - 10 hrs.*
- Testing Period – Start: *Monday, September 09, 2013* Finish: *Friday, September 13, 2013*
- Test Location: *Foyer Supreme, Inc. 3594 Jarry East, Montreal, Quebec H1Z-2G4 CANADA*
- Elevation: *187 Feet above sea level*
- Test Technician(s): *Gary Nelke*

Results: Emissions

The overall weighted average emission rate based on the 4 certification runs is **3.6 g/hr**.

Results							
Category 2 0.80 to 1.25 kg/hr		Category 2 .80 to 1.00 kg/hr		Category 3 1.25 to 1.90 kg/hr		Category 4 Maximum Burn Rate	
Date	9/9/2013	Date	9/11/2013	Date	9/11/2013	Date	9/12/2013
Run Number	1	Run Number	2	Run Number	3	Run Number	4
Emission Rate -g/Hr	1.44	Emission Rate g/Hr.	4.31	Emission Rate g/Hr.	3.62	Emission Rate g/Hr.	7.95
Burn Rate KG/hr	0.98	Burn Rate KG/hr	0.86	Burn Rate KG/hr	1.57	Burn Rate KG/hr	2.39
Overall Efficiency CSA B415 (HHV)	58.3%	Overall Efficiency CSA B415	60.4%	Overall Efficiency CSA B415	57.1%	Overall Efficiency CSA B415	55.4%
BTU (HHV)	10,802	BTU (HHV)	9,809	BTU (HHV)	16,794	BTU (HHV)	24,912

Table 1: Results

Results Summary Weighted Averages:

EPA Method 28 - Weighted Average



Weighted Average: 3.6 (g/hr)

Client: Foyer Supreme
 Model: Duet
 Tracking No.: 15
 Project No.: 019-S-015-1
 Test Dates: 9/9/13 - 9/12/13

Signature/Date: *[Signature]* 10/2/13

Burn Rate Category	2
Burn Rate (kg/hr-dry)	0.86
Emissions Rate (g/hr)	4.3
Emissions Rate Cap (g/hr)	15
Weighting Factor	21.23%
Run Number	2

Burn Rate Category	2
Burn Rate (kg/hr-dry)	0.98
Emissions Rate (g/hr)	1.4
Emissions Rate Cap (g/hr)	15
Weighting Factor	30.98%
Run Number	1

Burn Rate Category	3
Burn Rate (kg/hr-dry)	1.57
Emissions Rate (g/hr)	3.6
Emissions Rate Cap (g/hr)	18
Weighting Factor	35.22%
Run Number	3

Burn Rate Category	4
Burn Rate (kg/hr-dry)	2.39
Emissions Rate (g/hr)	8.0
Emissions Rate Cap (g/hr)	18
Weighting Factor	12.57%
Run Number	4

Table 2: Weighted Average

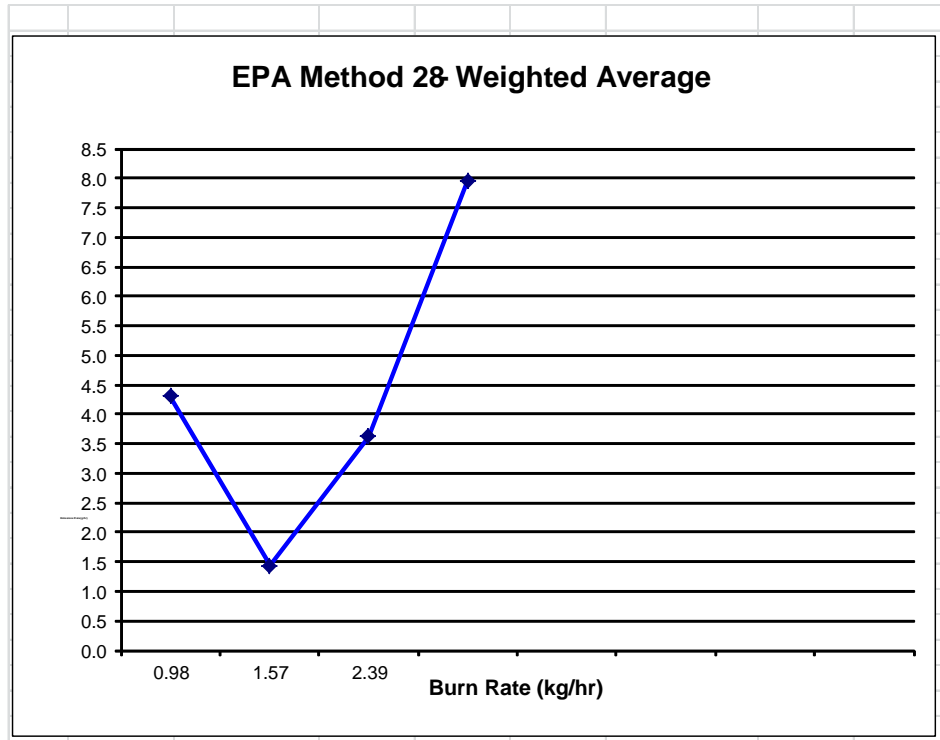


Table 3: Weighted Average Graph

Results Summary: Efficiency

Overall Weighted Average Efficiency using the Higher Heating Value is **58.0%**.

EPA Method 28 - Weighted Average



Overall Efficiency HHV

Weighted Average: **57.96%**

Client: Supreme
 Model: Duet
 Tracking No.: 15
 Project No.: 019-S-015-1
 Test Dates: 9/9/13 - 9/13/13
 Signature/Date: *[Signature]* 10/3/13

Burn Rate Category	2
Burn Rate (kg/hr-dry)	0.86
Emissions Rate (g/hr)	0.6
Emissions Rate Cap (g/hr)	15
Weighting Factor	21.23%
Run Number	2

Burn Rate Category	2
Burn Rate (kg/hr-dry)	0.98
Emissions Rate (g/hr)	0.6
Emissions Rate Cap (g/hr)	15
Weighting Factor	30.98%
Run Number	1

Burn Rate Category	3
Burn Rate (kg/hr-dry)	1.57
Emissions Rate (g/hr)	0.6
Emissions Rate Cap (g/hr)	18
Weighting Factor	35.22%
Run Number	3

Burn Rate Category	4
Burn Rate (kg/hr-dry)	2.39
Emissions Rate (g/hr)	0.6
Emissions Rate Cap (g/hr)	18
Weighting Factor	12.57%
Run Number	4

Overall Weighted Average Efficiency (HHV)

Test Condition Summary:

All testing conditions for runs 1,2,3,& 4 fell within allowable specifications of Method - 28. A summary of facility conditions, surface temperature averages, temperature averages, pre-test fuel weights, test fuel charge weights and run times is listed below in Table 4.

Runs	Ambient (Deg. F)		Relative Humidity (%)		Average Surface Temp. (Deg. F)		Barometric Pressure (In. Hg.)	Pre-Test Fuel End Wt. (Lbs.)	Test Fuel Charge Wt. (Lbs.)	Test Fuel Moisture (Dry Basis)	Run Time (Min.)
	Pre	Post	Pre	Post	Pre	Post					
1	83	85	57	69	328	222	29.79	4.56	22.21	20.2	510
2	83	85	69	67	328	209	29.79	4.49	22.1	20.0	580
3	83	91	70	71	328	263	29.94	4.49	22.1	19.9	320
4	83	85	59	59	429	417	29.66	4.46	22.15	20	210

Test Condition Summary

Heater Specifications:

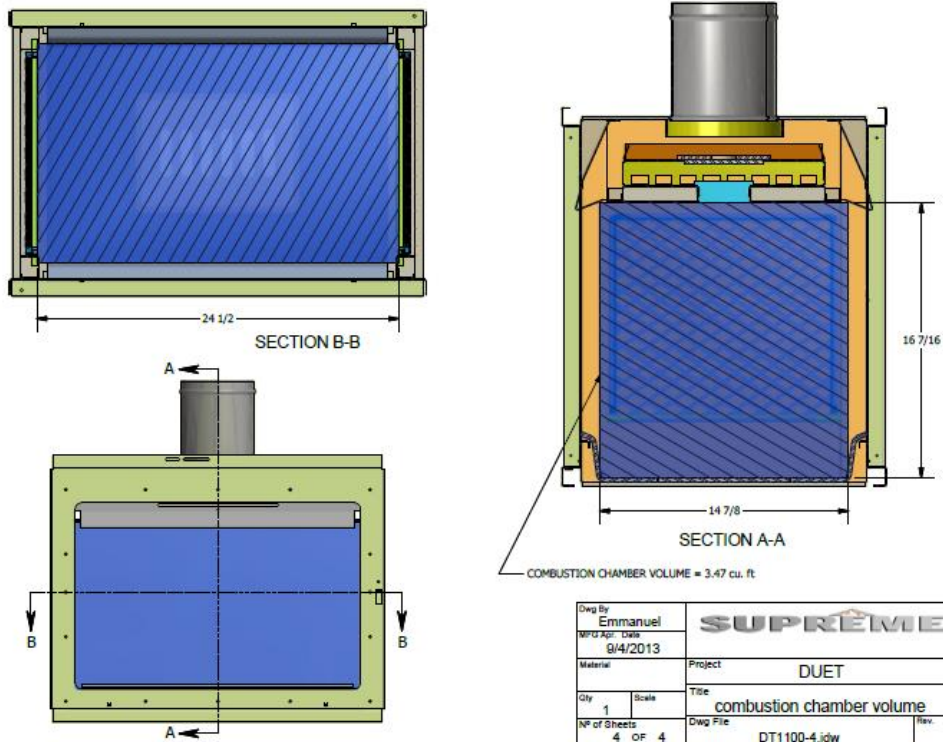
Dimensions, firebox configuration, air supply locations, air introduction locations, and baffle locations of the wood heater are referenced below.

Heater Dimensions				
Height	Width	Depth	Firebox Volume	Weight
41 -5/8"	31-7/16"	19-3/8"	3.47 Cu.Ft	220 Lbs

Heater Dimensions



Front Of Unit



Firebox

Process Operations and Description:

The appliance was operated according to procedures as described in the Operations Manual – (see appendix I). Primary air supply settings, fuel bed adjustments, test fuel properties, test fuel configuration and loading density are as described below in Tables 6, and Figure 8. All draft measurements for all 5 runs were less than 1 ft³ per minute. See Appendix F for detailed run information.

	Burn Cat.	Primary Air Setting	Run Notes	
			Pre-Burn	Test Run
Run1	2	60 ⁰	6:10am-22.5lbs to start, 6:56 mixed wood, 7:00 start 60 min, 7:05, 7:10, 7:14.7:28,7:39, mixed coals. 7:57 adjusted coal bed. 8:15 Start test –	Start test at 8:15 – door open 15 Seconds. No additional adjustments made.
Run 2	2	60 ⁰	6:23am-21.9 lbs. 7:03,7:11,7:18, 7:20 start 60 min,7:26, 7:32, 7:40, 7:50, 7:57, 8:00 mixed coals. Start Test at 8:23,	Start Test at 8:23 – door open 15 seconds. No additional adjustments made.
Run 3	3	80 ⁰	5:30pm -22lbs , 6:35 start 60 min. 6:45 6:50, 7:00, 7:20,7:25, mix coals. Start test 7:35	Start Test at 7:35 – door open 15 seconds
Run 4	4	Max-150 ⁰	7:24 -22.7lbs -8:00 mix, 8:07 start 60 min. 8:10,8:20,8:50,8:57,Mix coals. Start Test 9:19	Start test at 9:19 - door open 15 seconds. Changed front filters @ 1hr 15min

Settings & Run Notes

CONFIDENTIAL

CONFIDENTIAL

Primary Air Slide

CONFIDENTIAL

Air Flow Schematic (1)

CONFIDENTIAL

Air Flow Schematic (2)

Test Fuel Properties:

All test fuel charges consisted of 6 pieces of 4" x 4"x 20" douglas fir dimensional lumber and were assembled per Method 28 specifications. Details the fuel charges can be seen below. All fuel crib moisture content and temperatures were within allowable limits.



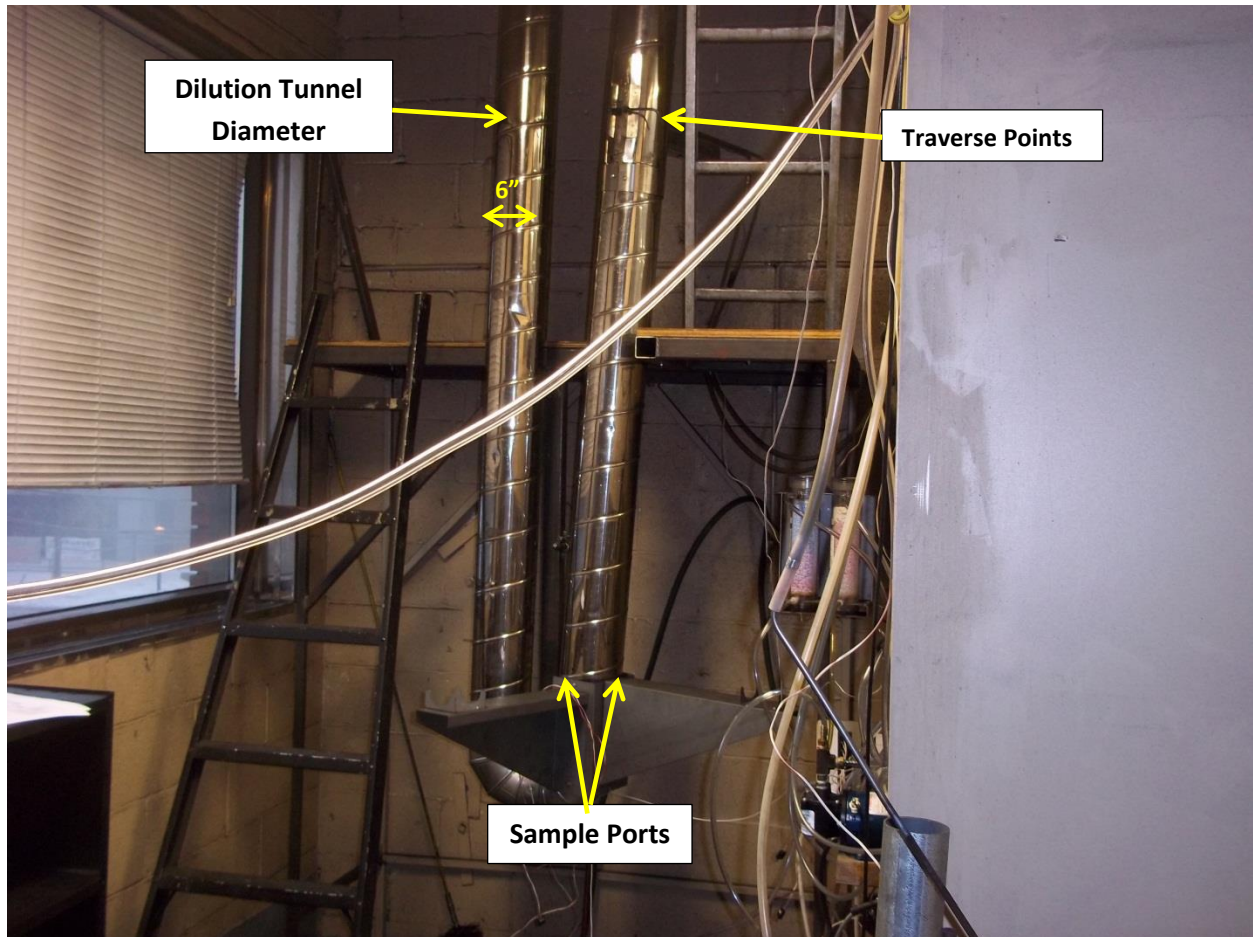
Fuel Load (1)



Fuel Load (2)

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:

A dual filter dry sampling train system (5G sample option 3) was used in collecting particulate samples. The dilution tunnel is 6 inches in diameter. All sampling conditions per method 5G option 3 were followed. No alternate procedures were used.

Sampling and Analytical Procedures

All sampling and analytical procedures used followed EPA Methods 1, 2, 3, 4, 5 and 28.

Analytical Methods Description:

All sample recovery and analysis procedures followed EPA Method 5 procedures. At the end of each test run, filters and probes were removed from their housings, dessicated for 24 hours, and then weighed to a constant weight per Method 5 section 11.0.

Calibration, Quality Control and Assurances:

Calibration procedures and results were conducted per EPA Method 1 through 5 and Method 28. Calibration certificates and results can be found in Appendix F.

Test method quality control procedures (leak checks, volume meter checks, stratification checks, proportionality results) followed the procedures outlined in Method 5.

Upon completion of testing, the unit was sealed with metal strapping and labeled with the following seal:

ATTENTION:

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

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

REPORT # _____ DATE SEALED _____

MANUFACTURER _____ MODEL # _____



Sealed unit

Appendices:

Appendix A:

Sampling and Analytical Procedures

All Sampling and analytical procedures were performed by Gary Nelke. All procedures used were directly from EPA Methods 1, 2, 3, 4, 5 and 28. No alternative procedures were used for this test series.

Appendix B:

Participants

The following personnel performed all testing.

- Gary Nelke CMfgE, Vice President, Dirigo Laboratories, Inc.

Analysis and Report Writing

The following people were involved with analysis and report writing.

- Gary Nelke CMfgE, Vice President, Dirigo Laboratories, Inc.
- John Steinert, President, Dirigo Laboratories, Inc.

Observers:

The following people were observers during testing:

- Emmanuel Marcakis, President, Foyer Supreme,

Appendix C:

Appliance Updates

- There were no changes made to the appliance.

Appendix D:

Test Equipment Calibration Audit:

- Calibrations for the platform scale and bench scale were performed with a certified 10lb weight.
- Moisture meter calibration was performed with Delmhorst moisture meter calibrator.
- The CO, CO₂, and O₂ analyzer were calibrated using NIST traceable gases.